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Thesis

A STUDY IN THE PITCH OF ORAL READING OF  
FOURTH GRADE CHILDREN

Submitted by

Harold Leonard Burke

(A.B., Emerson, 1938)

In partial fulfillment of requirements for  
the degree of Master of Education

1939

First Reader: Donald D. Durrell, Professor of Education  
Second Reader: Edward J. Eaton, Professor of Education  
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Gift of H. L. Burke  
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Aug. 9, 1939  
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He is grateful to Dr. J. Edgar Hoover for the financial support of this investigation, and to the various agencies and individuals who have assisted him in the completion of this study.

For permission to conduct the experiment in the various public schools, thanks are due to Miss M. J. Jones, Director, and to the various principals who have assisted him in the completion of this study.

He is grateful to Dr. J. Edgar Hoover for his assistance in the completion of this study, and to Miss Virginia F. Taylor for her assistance in the preparation of the manuscript.







### Acknowledgments

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To Professor Edward J. Eaton for the lending of a speech recording machine, without which this investigation could not have been undertaken, gratitude is here expressed.

For permission to conduct the experiment in the Medford Public Schools, thanks are due to Miss Olive G. Carson, Elementary Supervisor, who, in addition, lent much assistance during the initial recordings.

To Mr. J. Francis Shields for assistance in the recording, and to Miss Virginia W. Playfair for aid in the analysis of data, appreciation is expressed.



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## INTRODUCTION

For much of the work on German and French literature I am greatly indebted to the work of Edward Scribner and Alfred Hart. This obligation is acknowledged here and throughout.

INTRODUCTION



## Introduction

The purpose of this investigation is to study the  
difficulties of children in learning to read in  
reading material of easy, medium and difficult nature.  
The related problems of this investigation are:

1. To attempt to determine the effect of  
difficult reading on the child's  
learning.
2. To attempt to determine whether all  
children learn to read at the same  
rate and at the same age.
3. To attempt to determine whether the  
pitch of the voice is more directly a  
result of habit than of any inherent  
reading difficulty.

For much of the information on German  
and French research I am greatly indebted  
to the work of Edward Scripture and Alfred  
Root. This obligation is acknowledged  
here and throughout.

- A. Observational, or qualitative research
- B. Experimental, or laboratory research
- C. General, or theoretical research, not  
properly in the above categories.

For much of the information on German  
and French research I am greatly indebted  
to the work of Edward S. Rogers and Alfred  
Rosen. This chapter is indebted  
to them and their work.



## Introduction

The purpose of this investigation is to study pitch differences of childrens' voices in conversation and in reading material of easy, average and difficult mastery.

The related problems of this investigation are:

1. To attempt to determine the effect of difficult reading on the pitch of the voice.
2. To attempt to determine whether all oral reading utilizes a pitch level above that of conversation.
3. To attempt to determine whether high pitch of the voice is more directly a result of habit than of any apparent reading difficulty.
4. To attempt to determine how reliably the pitch of the speaking voice may be evaluated by competent judges.

The pitch of the speaking voice has for many thousands of years captured the interest - and in many instances, the imagination - of researchers and students to no small degree. Thus, in order to summarize the rather extensive work in this field, a rather arbitrary division of the research has been made in order to catalogue significant findings under uniform headings. Since these divisions are arbitrary, they cannot be followed in detail, but an attempt is here made to place a few previous investigations under one of the following three headings:

- A. Observational, or speculative research
- B. Experimental, or laboratory research
- C. General, or significant research not properly in the above catagories.

## Introduction

The purpose of this investigation is to study the  
different types of children's voices in conversation and in  
reading material of easy, average and difficult material.  
The related problems of this investigation are:

1. To attempt to determine the effect of  
different reading material on the pitch of the  
voice.
2. To attempt to determine whether all  
equal reading material elicits a pitch level  
above that of conversation.
3. To attempt to determine whether the  
pitch of the voice is significantly different  
as a result of reading from that of conversation.  
Reading Material.
4. To attempt to determine how reliably  
the pitch of the speaking voice may  
be estimated by conversational material.

The pitch of the speaking voice has for many thousands

of years captured the interest - and in many instances, the  
imagination - of researchers and students to no small degree.  
Thus, in order to summarize the rather extensive work in this  
field, a rather arbitrary division of the research has been  
made in order to capture the different elements under various  
headings. Since these divisions are arbitrary, they cannot  
be followed in detail, but an attempt is here made to show  
a few previous investigations, and one of the following three

headings:

1. Experimental, or descriptive research.
2. Experimental, or laboratory research.
3. General, or statistical research not  
properly in the above categories.



## A.

The earliest research that is still valid is that of <sup>/1</sup>Aristoxenus, who in 350 B.C. differentiated between speech and song. The difference lies apparently not in the kind of vibration, but in the manner in which the tone of the voice runs up and down in pitch. Song, AristoXenus characterized as a movement of pitch from one stationary point to another to another, while speech is a continuous pitch movement even within the vowels and consonants themselves. This point of view which strongly suggested the need of scientific verification; has waited two thousand years for further research, and only with the last two decades had this observation been confirmed.

300 years later, Dionysius of Halicarnassus <sup>/2</sup> related music and speech by saying that they differed in degree, not in kind. The melody of spoken language was compassed by a single interval of the fifth. The pitch in the utterance of a single word was found constantly to change, and take the form of a rising, falling or circumflex movement. This viewpoint is interesting in that it reappears continuously in speech literature, and seems to be well substantiated by subsequent research.

<sup>/1</sup> AristoXenus, Harmonica Quoted from E.W.Scripture, Elements of Experimental Phonetics, pg. 268, which is quoted in turn from a thesis by Johnson, Musical Pitch and the Measurement of Intervals, Baltimore, 1896.

<sup>/2</sup> Dionysius of Halicarnassus, W.R.Roberts, London, MacMillan 1910, quoted from Root, A.R. "The Pitch Factor in Speech" Quarterly Journal of Speech XVI, 1930 No.3, p.320-341





Following the ideas of Dionysius, though misinterpreting his purposes, Joshua Steele<sup>/1</sup> believed that the rises and falls of the voice pass through an interval of three and a half tones. Thus, believing that music and speech have common qualities, he attempted to reduce the inflection of speech to the intonation of music, with musical notes and notations for the benefit of the oratorical student who would follow his manual.

The folly of having our orators become singers as well was perpetuated by Rush<sup>/2</sup>, whose textbook on the Philosophy of the Human Voice became a major influence among the elocution teachers of the early 19th century. Rush also believed that the musical system of notation could be employed in speech, though somewhat differently. He felt it advisable to adopt musical notations to represent the function of the voice. Thus, representations of "concrete" sounds or slides, "discrete" sounds, scales, radicals and vanishing movements were all applied to speech. In addition, the attempt was made to interpret the various movements according to the meaning expresses.

Twenty years later, Alexander Melville Bell<sup>/3</sup> followed the theory of Aristoxenus and Dionysius of Halicarnassus, that the voice moves by sweeps over all intervening intervals, hence

<sup>/1</sup> Steele, Joshua Prosodia Rationalis, London, 1775

<sup>/2</sup> Rush, J. The Philosophy of the Human Voice, The Library Company, Philadelphia, 1827

<sup>/3</sup> Bell, A.M. The Principles of Speech, Edinburg, W.P. Kennedy, 1849

Following the ideas of Whistler, those who administered  
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to adopt musical notations to represent the function of the  
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"diatonic" sounds, scales, radicals and various movements  
were all applied to speech. In addition, the system was  
made to interpret the various movements according to the  
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Twenty years later, Alexander Melville Bell followed the  
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Steele, Josiah Steele's Philosophy, London, 1875

Steele, J. The Philosophy of the Human Voice, The Library  
Company, Philadelphia, 1875

Bell, A.M. The Principles of Speech, Edinburgh, E.T. Bell  
Co., 1893



the very nice systems of notation adopted by both Rush and Steel were valueless. However, he did use in his work a staff with musical notes to show graphically the degrees of inflection. He fully realized that the staff, and the notes thereupon affixed did not truly represent speech inflections with precision, and the voice, while following to some extent the outlined patterns, might deviate by many tones or by semi-tones throughout.

This point of view, which is entirely correct, was substantiated by the work of Ellis,<sup>/1</sup> who not only enlarged upon the idea of indefiniteness and vagueness in the slides and glides of the voice without definitely intended or perceived intervals and sustained tones, but also commented upon the presence of registers in the voice. Thus, he felt, every voice possessed a relatively high, medium and low pitch, regardless of the prevailing tone of speech.

A few years later, in 1863, the opinion began to shift once again to the quasi-musical notion of speech, this with the writings of Merkel.<sup>/2</sup> He stated that in the perception of spoken sounds, melodies were heard, although there is a lack of definiteness in the beginnings of the intervals and the maintenance of a syllable on a note. This viewpoint has been rather thoroughly upheld by the German investigators,

<sup>/1</sup> Ellis, K. quoted from Alfred R. Root, op. cit.

<sup>/2</sup> Merkel, L. quoted from E.W. Scripture, "Studies of Melody in English Speech" Philosophische Studien 9 Band 1 Theil 1902, pg. 599

the very same system of notation adopted by both Bush and  
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the relationship of a definite tone. This viewpoint has  
been rather thoroughly upheld by the German investigators.

Ellis, A. quoted from Alfred A. Wood, op. cit.

Marshall, I. quoted from E. W. Simpson, "Studies of Melody  
in English Speech," Philosophische Studien, Band I, Heft II  
1900, pp. 500



with Wundt<sup>/1</sup>, Scripture<sup>/2</sup>, and Storm<sup>/3</sup> writing extensively on the melody in speech. Storm was of the first few to recognize the glide character of the speaking voice, and stated that the gliding of the voice through several notes made an impression of "unrefined, mixed, unmusical noise."<sup>/3</sup> Speech was, however, somewhat musical in nature since there was an intervallic effect. He said, "Everybody sings more or less in his speech, that is, he remains more or less on the tones, or forms more or less melodic tonal movements. In the latter case, there is a gliding through of harmonic intervals in which the beginning and end of tonal movement is distinctly heard."

Wundt<sup>/1</sup> considered melody in speech little more than a threshold to music. Glide tones, he felt, ran from one recognizable pitch to another, thus forming definite intervals. To each pitch one can assign a definite note, but the syllable as a whole is perceived with the pitch of the vowel. He further believed that the difficulty in recognizing speech intervals is due primarily to an inaccurate concept on the part of the observer concerning the size of the interval. The recognition of intervals in speech increase as the intervals approach the known musical ones.

Scripture<sup>/2</sup> was among the first to make extensive use of laboratory equipment in the analysis of sound and speech.

<sup>/1</sup> Wundt, W. Quoted from E.W. Scripture, Elements of Experimental Phonetics, op. cit.

<sup>/2</sup> Scripture, E.W. Researches in Experimental Phonetics The Carnegie Institution of Washington Publications, 1906

<sup>/3</sup> Storm, J. Quoted from Alfred R. Root, whose account this follows closely. Root has been previously cited.

with Wason, Borge, and Stern, writing exclusively on the  
subject in speech. Stern was of the first view to recognize  
the wide character of the speech interval, and stated that  
the duration of the vowel through several notes made an  
impression of "extended, mixed, tonal intervals." Stern was,  
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Stern considered melody in speech little more than a threshold  
to music. Little more, he felt, than two or three notes  
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interval concerning the state of the interval. The recognition  
of intervals is based on the intervals between the  
notes which are heard.  
Stern was among the first to make extensive use of  
intervallic movement in the analysis of sound and speech.  
Wason, A. noted from E.W. Borge, Director of Experimental  
Psychology, etc. etc.  
Stern, E.W. Borge, in Experimental Psychology, The  
Intervallic Movement of Speech Intervals, 1908  
Stern, E. Borge, and Stern, E. Borge, when sound is  
heard, it is not heard as a whole, but as a series of  
intervals.



His discussions are treated later, but his viewpoint on pitch is here cited: "The pitch of short sounds is hard to catch by the ear, not only because each sound contains many tones that influence the total impression, but especially because the pitch is always changing. Even from a long sound the ear receives only a vague impression of pitch when it is a changing one. These difficulties render it impossible to obtain by the ear any reliable data concerning the melody of speech."<sup>/1</sup> He further states that, "just what vocal sound is perceived by the ear depends largely upon the sensitiveness to differences and on the past sounds which are most familiar. The perception of a sound is greatly influenced by associative suggestions. Elements are unconsciously modified, suppressed to created. Even hallucinations of weak tones supposed to be physically present can be readily produced in nearly all normal individual by appropriate suggestions from the surroundings."<sup>/2</sup>

One of the last discussions of the empirical school is that offered by Saran,<sup>/3</sup> who, in discussing speech melody, felt that it could be interpreted according to a theory of dominant syllabic crest which consist of strongly intoned vowels and voice consonants. These, the uninitiate hear as spots or more or less extension and brightness. Between these

<sup>/1</sup> Scripture, E.W. Elements of Experimental Phonetics Scribners Sons Company, New York, 1902 pg. 473

<sup>/2</sup> as above, pg. 115

<sup>/3</sup> quoted from A. R. Root, op.cit.

His observations are repeated later, but his discussion of pitch  
 is not. The effect of pitch on the ear is hard to catch by  
 the ear, but only because each sound contains many tones that  
 influence the total impression, but especially because the  
 pitch is always changing. Even when a tone seems the same  
 because of a vague impression of pitch when it is a  
 constant one. These difficulties render it impossible to  
 obtain by the ear any reliable data concerning the nature of  
 speech. It is often stated that "just what vocal sound is  
 perceived by the ear depends largely upon the conditions  
 to differences and on the past sounds which are most familiar.  
 The perception of a sound is greatly influenced by expectation  
 and attention. Moments are continuously modified, repeated  
 to succeed. When perception of what tones are supposed to be  
 physically present can be readily changed in nearly all  
 cases, it is evident that perception is not a function of the  
 sound itself."

One of the best discussions of the physical nature of  
 sound is given by Benet, who, in discussing speech sounds, says  
 that it can be interpreted according to a theory of the  
 least reliable aspect which is that of acoustical physics  
 and which is concerned with the physical nature of the  
 sound or wave as it is produced and the process. Between these  
 two points of view, the physical and the psychological, there is  
 a wide gap, but it is not a wide one.

as above, p. 111  
 quoted from A. H. Jones, p. 111



dominant crests are found the pauses and voiceless sounds which are perceived as a dull, unsorted mass in the background.

The foregoing is a very brief outline of the observational type of research that is pertinent to the present investigation. With the growing impetus of the experimental work, (c. 1900) which followed closely the development of new apparatus that could successfully be adapted for phonetic work, the observational type of approach diminished considerably. The one important study of this type which has been published recently is discussed under Part C - general research. For the rest, it suffices that they claimed nothing original that has not been either proven or disproved by subsequent experimental research.

## B.

Strictly speaking, experimental work begins with the vibrating device of Scott.<sup>/1</sup> Scott was a proof-reader who chanced upon a description and drawing of the human ear in a text-book he was reviewing. He reasoned that an artificial ear could be built that would record graphically the vibrations of the speaking voice. In his phonautograph, as he named this device, a large receiving instrument carried at its end a thin membrane whose movement when agitated by vibration caused a tiny lever affixed the membrane to write upon a smoked paper fastened upon a revolving drum.

<sup>/1</sup>

Scott, Inscription automatique des sons de l'air au moyen d'une oreille artificielle, 1861; quoted from Scripture, Elements of Experimental Phonetics, op.cit.

Commentaries are found in the papers and also in the  
 which are contained in a bill, mentioned here in the footnote.  
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 type of research that is pertinent to the present investigation.  
 With the growing interest of the experimental work, (e.g. 1930)  
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 important study of this type which has been published  
 recently is discussed under Part 2 - General research. For the  
 rest, it suffices that they either contain no data that has  
 not been either proven or disproven by subsequent experimental  
 research.

Particular attention, experimental work dealing with the  
 vibrating device of Scott. Scott was a vocal-teacher and  
 showed upon a description and drawing of the human ear  
 in a text-book he was reviewing. He believed that an  
 ear could be used as a bell that would receive phonetically  
 the vibrations of the speaking voice. In his phonography,  
 as he named this device, a large recording instrument was carried  
 at the end of a thin recording wire which was attached to the  
 vibration caused a very faint record of the vibrations in  
 which upon a smaller scale he showed how a recording drum.

Scott, Instructional phonography and some of its use  
 Boston: H. W. Scott, 1911; 1st ed. 1911; 2nd ed. 1912.  
 321 pages. 11 cm. (Instructional phonography, no. 11.)



Subsequent improvements - which are not applicable to this investigation - were made by several researchers, notably Scripture, but the apparatus of Scott's remains unchanged in principle until 1914. Little was done directly with the pitch of the voice in general, for the experimentation was largely confined to obtaining fundamental frequencies of the vowel sounds, and to the process of transcribing speech curves which could be read easily. This is Scripture's greatest contribution to the field.

With the advent of the World War, Germany ceased to be the focal point of research in the area of speech skills. Almost immediately following the publications of C.E. Seashore<sup>/1</sup> on a new device (the Tonoscope) by means of which pitch of the voice could be read easily and more accurately than before, the center of research shifted to the University of Iowa, where to-day it still remains.

Seashore's contribution, though utilizing the manometric flame invented as an improvement for Scott's phonautograph, is entirely original. Essentially, it is a revolving, perforated drum, inside of which burns a manometric flame. Speech vibrations cause the flame to flicker, and the darkened area of dots on the drum indicate the pitch of the sound.

The applications of this apparatus to a study of pitch problems in speech were not so immediate as might have been

<sup>/1</sup>

Seashore, E.C. "The Tonoscope" University of Iowa Studies in Psychology IV, 1914 p. 1 - 12

...investigation - very much by the same method, notably  
...but the separation of Scott's form and sound  
...in English until 1915. Little was done directly with the  
...pitch of the voice in general, for the examination was  
...mainly confined to obtaining a standard frequency of the  
...voice sounds, and to the process of transcribing speech  
...curves which could be read easily. This is Scott's  
...greatest contribution to the field.

With the advent of the World War, activity ceased in  
...in the local point of research in the area of speech studies.  
...also, immediately following the publication of C.E. Scoville  
...on a new device (the Phonograph) by means of which pitch of  
...the voice could be read easily and more accurately than  
...before. The center of research shifted to the University of  
...Iowa, where it still remains.

Scoville's contribution, though utilizing the phonograph,  
...there involved as an improvement for Scott's phonograph, is  
...essentially original. Naturally, it is a revolution, compared  
...to the old of which forms a monument in time. Speech  
...studies came the time to think, and the changed  
...of the first instance the pitch of the sound.

The application of this suggestion to a study of pitch  
...in speech was not an isolated one, as might have been  
...in the University of Iowa Studies  
...in Phonology, 1911, p. 1-12



supposed. Dr. Seashore's principal interest in research is musical in nature, hence the studies under his direction which utilized the Tonoscope were largely concerned with musical pitch.

A representative study is that by Schoen<sup>/1</sup>, who began the scientific observation of the vibrato by studying the pitch variations in the singing of five artists. For objective observations, the Tonoscope was used, but it was found that Tonoscope readings were difficult to read, and prone to progressive errors. Hence, the next eight years were devoted to the development of the phonophotographic apparatus which produces a graphic record of the sound waves on motion picture film, thus providing a permanent record and the opportunity for more careful analysis. The credit for this improvement in speech analysing machines is hard to place, but most will agree that it belongs jointly to Metfessel<sup>/2</sup> and Simon<sup>/3</sup>. Complete descriptions of the apparatus are given by both authors, but the main parts of a laboratory type phonophotographic device are: (a) a large drum, about which standard motion picture film winds after (b) photographing the light reflected in

<sup>/1</sup> Schoen, M. "The Pitch Factor in Artistic Singing" University of Iowa Studies in Psychology VIII, 1922 pg. 230

<sup>/2</sup> Metfessel, M. "Technique for Objective Studies of Vocal Art" Psychological Monographs XXXVI, 1926 No. 1 p.1

<sup>/3</sup> Simon, C. "The Variability of Consecutive Wave Length in Vocal and Instrumental Sounds" Psychological Monographs XXXVI, 1926 No. 1 p. 40

hypothesis. Dr. Liberman's (1955) research in this area is  
 central to the study, hence the studies under this direction  
 which utilized the technique were largely concerned with  
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 speech analyzing machines is due to Liberman, but must also  
 credit that it belongs jointly to Liberman and Simon. Complete  
 observations of the system are given by both authors, but  
 the main work of a laboratory type phonograph is given  
 and a large part, about 75%, of the entire work is  
 this study of the phonograph. The work is reported in

Liberman, Y. "The Effect of the Phonograph on the Study of  
 of the Study in Phonology" Journal of the Acoustical Society of America  
 1955, Vol. 27, No. 1, p. 1.

Liberman, Y. "The Effect of the Phonograph on the Study of  
 of the Study in Phonology" Journal of the Acoustical Society of America  
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Liberman, Y. "The Effect of the Phonograph on the Study of  
 of the Study in Phonology" Journal of the Acoustical Society of America  
 1955, Vol. 27, No. 1, p. 1.



vibratory movement from two phonelescopes, the one a graphic representation of sound waves from an unknown pitch of the voice or another vibrating instrument, and the other from a known source of 100d.v. electrically driven tuning fork, this referred to as a "time line" (Metfessel) A phonelescope is an optical lever. A vibrating diaphragm moves a tiny mirror which vibrates synchronously with the movement of a phonelescope diaphragm. A light is reflected from the mirror of the phonelescope to a film.

Once again, the improved apparatus was devoted to the objective analysis of musical performance. Although that which is applicable to music is generally applicable to speech, little inference in these later studies was drawn from one to the other. It remained for C. Horton Talley<sup>/1</sup> and Milton Cowan<sup>/2</sup> to investigate speech with the aid of the newer type laboratory equipment. Talley used an oscillograph, and Cowan utilized the phonophotographic devices.

Horton took oscillograms of the voices of eight experienced actors under conditions approximating conversational and audience speech. By "approximating" is meant that the actors were asked to assume a conversational pitch and manner and say, "He has risen to the top of the professions." The same sentence was selected to be delivered as though speaking to an audience. The word "top" was chosen to be analysed by a harmonic analysis. He found, "In general, when a speaker

<sup>/1</sup> Talley, E.H. "A Comparison of Conversational and Audience Speech" Archives of Speech II no. 1 July 1937

<sup>/2</sup> Cowan, M. "Pitch and Intensity Characteristics of Stage Speech" Archives of Speech Vol. I No. 1 July 1936

Although movement from the phonological, the one a regular  
repetition of sound waves from an unknown pitch of the  
voice or another vibrating instrument, and the other from a  
known source of 1000 v. electrically driven tuning fork, this  
referred to as a "vibrating" (vibrating) & phonoscope is  
an optical device. A vibrating instrument moves a tiny mirror  
which vibrates synchronously with the movement of a diaphragm  
before the speaker. A light is reflected from the mirror of the  
phonoscope to a film.

Once again, the improved method was devoted to the  
objective analysis of musical performance. Although the  
which is applicable to music is generally applicable to  
speech, little inference in these later studies was drawn from  
one to the other. It remained for J. Newton Taylor and Wilson  
Gowen to investigate speech with the aid of the new type  
laboratory equipment. Taylor used an oscillograph, and Gowen  
utilized the phonoscope and his device.

Both took oscillograms of the voice of their experimental  
actors under conditions of varying conversational and  
audience speech. By "audience speech" is meant that the actors were  
asked to assume a conversational pitch and manner and say, "the  
has taken to the top of the mountains." The same sentence  
was collected to be delivered as though speaking to an audience.  
The word "top" was chosen to be analyzed by a harmonic analysis.

In Taylor, when a speaker  
Taylor, J. N. "A Comparison of Conversational and Audience  
Speech" Analysis of Speech, 11 no. 1 July 1937  
Gowen, J. "The Oscillograph and the Phonoscope in the  
Analysis of Speech" 11 no. 1 July 1937



changed from conversational to audience type of speech, three changes in the sound wave produced by the voice took place simultaneously, namely, heightened pitch, increased intensity and a shift of energy from the lower to the higher partials. It does not seem possible to evaluate the relative importance of the three factors, not to state whether one element causally influences the other two."

Cowan, as has been indicated previously, utilized the phonophotographic equipment of Metfessel and Simon. Extensive recordings and analysis of dramatic passages as interpreted by 14 actors and actresses were made. Measurements of average pitch, range of pitch, etc., are given, though they are not immediately applicable here. However, he did find that the average pitch level of a given individual in different selections have the same pitch range can vary as much as five semi-tones.

The above two investigations are the latest to be published from the Iowa laboratories. There is, at present, a study not yet published on the pitch changes of the speaking voice during emotional states, which will be released for publication during the academic year 1939-1940.

### C.

Under this heading of General Research are included three studies which properly do not belong with either of the above divisions because of either the chronological factor or because of their significance for this present





investigation.

The work of Alfred R. Root<sup>/1</sup> in his "Pitch Patterns and Tonal Movements in Speech" is, to some extent, similar in purpose to the present investigation. Root selected eleven phonograph records, from which 81 syllables of running speech were chosen as representative of an inclusive sampling of the most general pitch patterns used in American speech. Thirteen judges scoring high on a battery of acuity and musical aptitude tests were chosen to match each syllable of speech to the pitch of a reed organ. These pitches were matched to the nearest note, and from these judgements correlations were obtained. In order to further investigate the problem, phonophotography was employed in the objective re-analysis of the 81 syllables, as well as an additional 700 from the same material to investigate the possibility of undiscovered pitch patterns. He concludes that "the method of perceptual analysis has a high degree of consistency, as statements of observers, graphic representation and statistical treatment of results show." The average correlation among observers is .95 for dominantly perceived pitch, .86 for inflectional range and for observers in repeated analysis of the same material, .94 to .95. To correlate his first judgements, he used as a standard the judgments of one observer who was known to have the highest scores on auditory and vacomotor tests, and whose opinions were therefore assumed to be the

<sup>/1</sup>

Root, A. R. "Pitch Patterns and Tonal Movements in Speech" Psychological Monographs XXXX, 1930 No. 1

investigation.

The work of Albert E. Wood in his "Himalayan and  
Local Movements in Speech" is, in some extent, similar to  
purpose to the present investigation. Wood selected eleven  
phonetic records, from which 21 syllables of varying speech  
were chosen as representative of an individual's range of  
the most general speech patterns used in American speech. This  
fact makes possible a study on a basis of regularity and  
syllable type were chosen to match each syllable of speech  
to the type of the test. These syllables were grouped to  
the present study, and from these syllables conclusions were  
obtained. In order to further investigate the problem,  
a phonetic analysis was applied to the syllables in order to  
of the 21 syllables, as well as an additional 700 from the  
same material to investigate the possibility of individual  
differences. He concludes that "the method of phonetic  
analysis has a high degree of objectivity, as evidenced by  
objective, graphic representation and additional evidence  
of results shown." The study was further extended to  
is 85 for dominantly phonetic types, 85 for inflectional  
range and for comparison in repeated analysis of the same  
material, 85 to 95. To correlate his first findings, he  
used as a standard the judgment of one observer who was  
found to have the highest scores on auditory and phonetic  
tests, and whose analysis was selected as standard for the  
test. A. E. Wood, "Himalayan and Local Movements in Speech",  
Linguistics, Vol. 1, 1950, No. 1.



most reliable. The correlation on re-identification of pitch was obtained by matching the two judgments. This study is highly significant in view of the fact that it indicates rather positively that the extensive and elaborate equipment which has been thought essential to measure pitch and pitch variations is not necessary if but an average pitch level is desired.

A further important study is that of Weaver's<sup>/1</sup>, who likewise performed a series of experiments in the perception of sounds. Weaver investigated, among other things, the relationship between accuracy in producing vocal pitch and the sense of pitch. The coefficient of correlation between sense of pitch and accuracy of production was found to be  $\neq 0.808$  for the women in the investigation, and  $\neq 0.0881$  for the men. The cause for this disparity is not clear.

A second significant finding is that the errors in pitch (musical) can be detected with twice the accuracy for women's voices than for men's. The truth of this rests upon the assumption that the ear recognizes a change in a given number of vibrations with different acuity for the different registers; e.g. a change of ten vibrations at 300 d.v. would seem only half as great as a change of the same number of vibrations at 150 d.v.

The above findings relate directly to the present experiment in which women observers were used to judge the pitch of children's speaking voices.

<sup>/1</sup> Weaver, H.T. "Experimental Studies in Vocal Expression" Journal of Applied Psychology VIII, 1924, p 23.

most reliable. The correlation in re-identification of pitch was obtained by matching the two judgments. This study is highly significant in view of the fact that it indicates a strong possibility that the subjective and laboratory measurements which have been obtained in laboratory pitch and pitch variations is not necessarily in but an average which level is required.

A further important point is that of accuracy, the like-ness, expressed a series of experiments in the perception of sounds. Various fundamental, complex other tones, the relation ship between accuracy in production, verbal pitch and the sense of pitch. The coefficient of correlation between sense of pitch and accuracy of production was found to be 0.80 for the women in the investigation, and 0.55 for the men. The sense for this disparity is not clear.

A second significant finding is that the error is about (or less) can be associated with twice the accuracy for women's voices than for men's. The truth of this is supported by the observation that the ear recognizes a change in a voice number of vibrations with different accuracy for the different ranges of 0.1 a change of ten vibrations at 200 v.v. would seem only half as great as a change of the same number of vibrations at 150 v.v.

The above results are directly in line with the statement in which it was shown that the ear is more accurate in the range of 150-200 v.v. than in the range of 200-250 v.v. The truth of this is supported by the observation that the ear recognizes a change in a voice number of vibrations with different accuracy for the different ranges of 0.1 a change of ten vibrations at 200 v.v. would seem only half as great as a change of the same number of vibrations at 150 v.v.



On the subject of the pitch of the voice in oral reading,<sup>/1</sup> little has been written. One study by Charles H. Woolbert<sup>2</sup> concerning the pitch of the voice and the effectiveness of the reading was performed some years ago, and although the results are not of great concern here, he concludes that the greater the range of pitch, the more pleasing and effective is the reading.

This summarizes the research pertinent to the present investigation, which has as its purpose the study of the pitch of conversation and oral reading of fourth grade children in an attempt to determine the effect of difficult reading on the pitch of the voice, and to attempt to determine how reliably the pitch of the speaking voice was evaluated by observational methods.

<sup>/1</sup> Woolbert, C.H. "Effects of Various Modes of Reading"  
Journal of Applied Psychology IV, 1920 No.2 p.162

On the subject of the pitch of the voice in oral reading, little has been written. One study by Charles H. Woodbury concerning the pitch of the voice and the effectiveness of the reading was published some years ago, and although the results are not of great consequence, he concluded that the speaker, in the range of pitch, the more pleasing and effective reading.

This summarizes the research pertinent to the present investigation, which was as its purpose the study of the pitch of conversation and oral reading of four groups of children in an attempt to determine the effect of different reading on the pitch of the voice, and to attempt to determine how well the pitch of the voice was evaluated by observational methods.



General Description of this Investigation

This study was conducted with 31 pupils in a fourth grade of the United Public Schools, Chicago, who are considered as normal. The number of years complete data has been obtained is 22. There were 14 boys and 17 girls, with a chronological age range of 105 months to 137 months. As measured by the "Personality Achievement Test" (see Table A, Appendix) the group scores range from 7 to superior, although the predominant language background of these pupils, as well as native or second language, is foreign. The location of the school is in a semi-commercial zone, and the parental occupation is, in most instances, unskilled labor.

GENERAL DESCRIPTION OF THIS INVESTIGATION

This investigation required the electrical recording of vocal and recalled messages from three paragraphs of the "Marshall Analysis of Reading Circulation" (Paragraphs 2, 4, and 5 of "Oral Reading, What's Oral Reading?"). These paragraphs are numbered according to grade levels. The recording equipment used was the type 7-7 recording machine, manufactured by the Frank Beardsley Company, New York City. A specialized crystal microphone was attached to this machine.

After a preliminary investigation, with a different group of pupils, it was determined that oral conversation could not be obtained in this situation. The following were the reasons for this: (1) the conversation was too noisy, and (2) the conversation was too short.

GENERAL ACCOUNTS OF THE INVESTIGATION



### General Description of this Investigation

This study was undertaken with 31 pupils in a fourth grade of the Medford Public Schools, although, due to unusual circumstances, the number on whom complete data has been obtained, is but 29. There were 13 boys and 16 girls, with a chronological age range of 105 months to 137 months. As measured by the "Metropolitan Achievement Test" (see Table A, Appendix) the group score from average to superior, although the predominant language background of these pupils, as well as nativity in three instances, is foreign. The location of the school is in a semi-commercial zone, and the parental occupation is, in most instances, unskilled labor.

This investigation required the electrical recording of spontaneous natural conversation, and the oral reading and recall of selected passages from three paragraphs of the "Durrell Analysis of Reading Difficulty", (paragraphs 2,4, and 6 of 'Oral Reading, Unaided Oral Recall'.) These paragraphs are numbered according to grade levels. The recording equipment used was the type D-7 recording machine, manufactured by the Presto Recording Company, New York City. A concealed crystal microphone was attached to this machine.

After a preliminary investigation, with a different fourth grade, it was determined that natural conversation could not be obtained if: (1) evidences of recording were present, and (2) the conversation was held by the examiner

General description of this investigation  
This study was conducted with 31 pupils in a fourth grade  
of the Bedford Public Schools, at Bedford, New York.  
Furthermore, the number on whom complete data has been  
obtained, is but 20. There were 15 boys and 15 girls, with  
a chronological age range of 104 months to 137 months. As  
measured by the "Heteroclitian Achievement Test" (see Table 1,  
Appendix) the group score from 100 to 120, although  
the predominant language background of these pupils, as well  
as activity in other instances, is English. The location of  
the school is in a semi-urbanized zone, and the general  
occupation is, in most instances, unskilled labor.  
This investigation required the electrical recording  
of spontaneous speech and vocalization, and the oral reading  
and recital of selected passages from three versions of the  
"General Analysis of Speech" (Miller, 1934), (Appendix 2, 3,  
and 4 of "Speech Analysis, Unpublished Manuscript"). These pas-  
sages are numbered according to grade levels. The recording  
equipment used was the type 7-7 recording machine, manufac-  
tured by the Radio Corporation of New York City. A  
revised system of notation was devised for this machine.  
After a preliminary investigation, with a different  
group of pupils, it was determined that manual conversation  
could not be obtained; (1) evidence of recording was  
poor, and (2) the conversation was held at the expense



and one child alone, or by two children and the examiner. It seemed expedient at this point to adopt the following routine:

(1) A small airy room was selected, to which a closet of adequate size was connected by both a door and a window. In this closet was placed all the recording equipment. The room itself was furnished with a rug, desk, chairs, lamps, and books, to make the surroundings as attractive and as physically comfortable as possible.

(2) The microphone was concealed in a desk lamp, and placed on the desk about a foot removed from the subjects' chair. The cord connecting the microphone to the recording machine was concealed under the rug, and ran to a corner, out of the subjects' line of vision, through a window and into the closet.

(3) By arrangement with the home room teacher, pupils were sent to this testing room in groups of two. It had been our intention to pair off the girls with the boys in order to eliminate difficulty in the identification of voices from the records, but this plan had to be abandoned, since the boys in the group were extremely reticent in carrying on a conversation with the girls. Thus, after the first two records, the children were paired off on the basis of comradeship, rather than on sex.

(4) Each pair of pupils was met in the corridor by the examiner, who escorted the children to the testing room. Inside the room, the pupils were seated in chairs that already had been carefully placed in reference to the

and one child alone, or by two children and the examiner. It seemed excellent at this point to adopt the following procedure:

(1) A small ring was selected, to which a string of approximately 12 inches was connected by means of a window. In this case, the string was placed in the recording instrument. The room itself was furnished with a rug, desk, chair, lamp, and books, to make the surroundings as attractive and as physically comfortable as possible.

(2) The telephone was concealed in a dark lamp, and placed on the desk about a foot removed from the subject's chair. The cord connecting the telephone to the recording machine was concealed under the rug, and ran to a corner out of the subject's line of vision, through a window and into the closet.

(3) By arrangement with the home room teacher, the subject was sent to his room in the middle of the day. It was then our intention to call the subject into the room in order to eliminate difficulty in the identification of voices from the records, but this plan had to be abandoned. Since the boy in the room was extremely nervous in connection with a conversation with the girls, after the first two records, the subject was called off on the basis of comeliness, rather than on sex.

(4) Each pair of girls was met in the corridor by the examiner, who escorted the children to the testing room. Inside the room, the girls were seated in chairs that



microphone. It was here explained that the purpose of this examination was to determine if any reading progress had been made since the administration of a reading achievement test by the examiner a month before. Each child was definitely told that this test would not affect his school grades in the slightest, and any results obtained were to be used only in a very general way. This statement was not made any more specific nor comprehensible.

(5) At this point, the examiner asked if either of the children had seen Miss "C." - the elementary supervisor - who, it was stated, was expected to visit the examiner sometime during the course of the reading, but had not yet appeared. On receiving no information, the examiner asked to be excused, and stated that he was going to telephone Miss "C.", and also to speak to the principal, but would return in five or six minutes. This rather weak excuse for leaving the room was varied several times, in the event that pupils once back in the home room would relate to one another their experiences with the examiner. The pupils were asked not to leave the chairs upon which they were sitting and wander about the room, since the office was not the property of the examiner, and if anything were broken or disturbed, the consequences would be embarrassing for all concerned. The examiner then left the room.

(6) Recording of the pupil's conversation was begun four or five minutes after the examiner had left, the time interval varying somewhat according to the volubility of

misconduct. It was here explained that the purpose of this examination was to determine if any reading progress had been made since the administration of a reading achievement test by the examiner a month before. Each child was individually told that this test would not affect his school grade in the slightest, and any possible objection was to be noted only in a very general way. This statement was not made any more specific than could be.

(B) At this point, the examiner asked if either of the children had seen Miss "C." - the elementary supervisor - who, it was stated, was expected to visit the examiner sometime during the course of the testing, but had not yet appeared. On receiving no information, the examiner asked to be excused, and stated that he was going to telephone Miss "C.", and also to speak to the principal, but would return in five or six minutes. This twenty-week exercise for leaving the room was varied several times, in the event that pupils came back in the room while waiting to see another third grader with the examiner. The pupils were asked not to leave the office upon which they were sitting and under what the room, since the office was not the property of the examiner, and it was their responsibility to be disturbed, the consequences would be severe. By all concerned. The examiner then left the room.

(C) Recalling of the pupil's conversation was made four or five minutes after the examiner had left, and also before the final examination was given to the children.



the subjects' conversation. On no occasion was the recording begun until four minutes had elapsed, although with six children it was necessary to remain out of the room as long as ten minutes. Four minutes after the examiner had left, the room was rather arbitrarily selected as the time to begin recording, since it was felt that during this interval the subjects would become somewhat acclimatized to this situation, would neither whisper nor move away from their microphone position, and would employ in any ensuing conversation a normal pitch level. This assumption of acclimatization seems to have been proven quite true for this group, if we may take as our criteria the wide, and occasionally amusing, range of conversational material unrelated to the testing situation which our records distinguish.

(7) When sufficient natural conversation had been obtained, the assistant signaled the examiner, who promptly entered the room. No comment was made other than a brief apology for the delay. The names and ages of the subjects were secured and noted. The examiner then suggested that inasmuch as this was an individual test, and the same material was to be read at sight by both children, one of the pupils should leave the room and wait in the corridor where a chair had been provided.

(8) Before beginning reading, the child was told that he was to read aloud two paragraphs, and to tell the examiner all he could remember about them. It was further stated

The subject's conversation. When the subject was the  
room as long as ten minutes. Four minutes after the  
examiner had left the room was rather slightly agitated  
at the time to be in recording, since it was left last  
during this interval the subject would become somewhat  
acclimated to this situation, would neither withdraw nor  
move away from their attention position, and would appear  
to any ensuing conversation a normal child level. This  
assumption of acclimation seems to have been proved  
quite true for this room, in no way take an outburst  
the wife, and occasionally another, trace of conversation  
material unrelated to the testing situation which our  
records distinguish.

(1) When sufficient material conversation had been obtained,  
the assistant advised the examiner, who promptly entered  
the room. No comment was made other than a brief apology  
for the delay. The subject and some of the subjects were  
excused and noted. The examiner then returned to the  
room as this was an individual test, and the same material  
was to be read as a group of children, one of the pupils  
should leave the room and wait in the corridor where a  
child had been assigned.

(2) Before continuing reading, the child was told that he  
was to read aloud the paragraphs, and to tell the examiner  
all he could remember about them. It was then stated



that if he were to read these two well, he might be allowed to attempt a sixth grade paragraph, "just for fun". As each child read, his errors were scored by the examiner, and the time and the number of ideas in his recall was noted. While the child was reading, certain selected sentences in the reading were permanently recorded. The sentences to be recorded had previously been selected on the following bases:

- (A) Position of the sentence in the paragraph. (It was desired not to select sentences near the beginning of the paragraphs, since both the newness of the situation and unfamiliarity with the material might cause artificial pitch levels.)
- (B) Repetition of some of the words in each of the sentences. The words "a" and "he" occur in all three sentences, "was", "to" and "when" occur in two.
- (C) Number of vowel sounds. To many of the consonants, especially the gutturals, it is difficult to assign definite pitches. If our material to be analysed could contain a minimum of these, our material would be less difficult to evaluate.

The complete paragraphs read, and the sentences recorded from each, may be found in the appendix, page ii.

(9) After each child had read and had stated as accurately as possible the content of each paragraph, including the sixth grade paragraph, he was asked to exchange places with the child waiting in the corridor. He was urged to tell the other child the nature of the test, and whether or not he thought it difficult. Since the general spontaneous comment was to the effect that the test was far less difficult than imagined, and since the child in the corridor might, by this time, be considerably apprehensive of the

that it was not clear that the child was attempting to repeat the words "just for fun". As each child heard, the words were noted by the experimenter, and the time and the number of times in this record was noted. While the child was talking, certain selected sentences in the reading were parenthetically recorded. The sentences to be recorded were provisionally selected on the following basis:

- (A) Position of the sentence in the paragraph. It was desired not to select sentences near the beginning of the paragraph, since both the nature of the situation and the child's level of interest might cause an initial high level. Position of some of the words in each of the sentences. The words "a" and "the" occur in all three sentences, "was", "to" and "when" occur in two.
- (B) Number of vowel sounds. To many of the consonants, especially the fricatives, it is difficult to assign a value. If we attempted to do this, we would find a number of places, but material would be less difficult to analyze.

The analysis of the words, and the sentences recorded from each, was found in the appendix, page 11.

(C) After each child had read and had stated as accurately as possible the content of each sentence, including the sixth grade paragraph, he was asked to reproduce phrases with the child waiting in the corridor. He was asked to tell the other child the nature of the test, and whether or not he thought it difficult. Since the verbal responses were not to be recorded, the first was not less difficult than the second, and since the child in the corridor, by this time, was not a stranger, the nature of the



interview, this was thought wise. When the other child had entered and been seated, the examiner repeated the same introductory comments, not mentioning, unless directly questioned, whether the previous child had succeeded in reading the sixth grade paragraph. The motivating force of this device, merely calculated to soothe any feeling of insecurity or apprehension, was considerable, for by the end of the day, those children who had not yet read volunteered to remain after school as long as necessary to see if they, too, could read well. This, of course, was not permitted, since the fatigue factor and the general high feeling might have invalidated the results.

(10) The order of the paragraphs to be read was changed slightly for those children numbered on the records as "B". Paragraph 4 was presented first, paragraph 2 was read second, and paragraph 6 was presented last. In records numbered as "A", the order is paragraphs 2, 4 and 6. In records from 12A to 15C - when the examination took place the next morning - the paragraphs were presented in this order: Paragraph 6, first, paragraph 2, second, and paragraph 4, third. These irregularities in procedure were permitted in order that we might observe the effect on the pitch of the voice if the children read difficult material first.

In summary: all children numbered as "A" - from record

interview, this was brought up. When the other child  
 had entered and been asked, the examiner repeated the  
 same introductory comments, and questioned, where directly  
 questioned, whether the previous child had succeeded in  
 reading the sixth grade paragraph. The motivating force  
 of this device, merely calculated to soothe any feeling  
 of inferiority or embarrassment, was considerable, for by  
 the end of the day, those children who had not yet read  
 volunteered to read after school as long as necessary  
 to see if they, too, could read well. This, of course,  
 was not permitted, since the future factor and the  
 general high feeling of the child invalidated the results.  
 (10) The order of the paragraphs to be read was changed  
 slightly for those children numbered on the records as  
 "B". Paragraph 4 was presented first, paragraph 5 was  
 read second, and paragraph 3 was presented last. In  
 records numbered as "A", the order is paragraphs 2, 4 and 3.  
 In records from 12A to 12E - when the examination took  
 place the next morning - the paragraphs were presented  
 in this order: Paragraph 3, then, paragraph 2, second,  
 and paragraph 4, third. These instructions in procedure  
 were printed in order that we might observe the effect  
 on the effect of the voice if the children read difficult  
 material first.

In summary: All children numbered as "A" - from records



1A up to but not including 12A - read in the order named, paragraphs 2, 4 and 6. All children numbered as "B" - from record 1B up to, but not including 11B - read in the order named, paragraphs 4, 2, and 6. All children from 12A to 15C read the paragraphs in this order: 6, 2, 4. All children read the same paragraphs during the course of the examination, although the order varied throughout.

(11) The last three children - records 15A, B, C - were allowed to sit in the room together, since it would have been impossible to obtain conversation from "C" had "A" and "B" first been paired off, leavin "C" without a conversational partner. With three pupils in the room, the conversation was much more spirited, although in matching the conversation to the reading, more difficulty was experienced.

(12) The records on two children (numbers 2B and 14B) are not treated in the data here, inasmuch as on child whispered in the conversation, and the other had left his chair and walked about the room while talking.

(13) The testing and recording for this experiment consumed one and one-half days.

#### Procedure in the Analysis of Data

When all the records had been obtained, the problem of how best to analyse the pitch, whether by empirical or scientific methods, presented itself. For several reasons, it was decided to use the purely subjective method of judgment by three qualified judges instead of the

in it to get not including 124 - read in the order named,  
paragraphs 2, 3 and 4. All children numbered as "B" - from  
124 up to 125, but not including 126 - read in the order  
named, paragraphs 2, 3 and 4. All children from 124 to 125  
read the paragraphs in this order: 2, 3, 4. All children  
read the same paragraphs during the course of the examina-  
tion, without the order varied throughout.

(11) The last three children - records 124, 125, 126 - were  
allowed to sit in the room together, since it would have  
been impossible to obtain a conversation from "C" and "A"  
and "B" first been paired off, leaving "C" without a  
conversational partner. With three pupils in the room,  
the conversation was much more spirited, although in  
reading the conversation to the reading, more difficulty  
was experienced.

(12) The records on two children (numbers 125 and 126) are  
not presented in the data here, inasmuch as no child  
was placed in the conversation, and the other had left the  
chair and walked about the room while talking.  
(13) The testing and recording for this experiment  
continued one and one-half days.

### Procedure in the Analysis of Data

When all the records had been obtained, the analysis  
of how best to analyze the data, whether by statistical or  
scientific methods, presented itself. For several reasons  
it was decided to use the purely subjective method  
of analysis by which the records were grouped as to



more reliable method of analysis by a stroboscopic or phonophotographic apparatus.

The first consideration in this decision was entirely financial. One could either have built or purchased the necessary equipment, or have the analysis made by a commercial company. The equipment may be purchased from the Vitagraph Company of New York City at a cost slightly in excess of one thousand dollars. The Massachusetts Institute of Technology (Professor Norman Bennett) was quite willing to cooperate in the construction of a type of cathode ray oscillograph, but with this type of device, approximately fifteen miles of film would be required to photograph the speech vibrations, and the data thus yielded would entail a thousand separate measurements. This type of apparatus was the only type then available in view of the limited time of the students who would construct the machine, and considering also the laboratory equipment not already in use.

The Western Electric Company (Mr. O. Carpenter, Educational Representative had, at one time, an experimental apparatus which would give precisely the measures desired, but it is no longer available for outside research. Professor F.V. Hunt, Cruft Laboratory, Harvard University, had a similar machine, at present, however, reassembled to form a part of the mechanism of another type of apparatus of quite dissimilar function. Professor Joseph Tiffin of Purdue University had the necessary equipment, but the cost of having this data

more reliable method of analysis by a spectroscopic or  
phonographic apparatus.

The first consideration in this decision was entirely  
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the machine, and consequently also the laboratory equipment  
not already in use.

The Western Electric Company Mr. C. Carpenter, Execu-  
tive Representative had, at one time, an experimental  
apparatus which would give practically the answers desired,  
but it is no longer available for outside research. Professor  
J. V. Hunt, Graft Laboratory, Harvard University, had a similar  
machine, at present, however, rescheduled to form a part of  
the mechanism of another type of apparatus at quite a similar  
location. Professor Joseph Willis at Brown University had  
the necessary equipment, but the cost of having this data



analysed commercially is approximately fifteen dollars per minute of speech.

A second consideration of equal weight in the discussion of how best to analyse the data, was the possibility that a genuine contribution to the speech field might be made if the data were to be treated experimentally as a study in the perception of speech sounds, attempting to substantiate to some extent the work of Alfred R. Root.<sup>1</sup>

In view of the above, it was decided that the procedure in analysis would be as follows:

(1) The obtained records were to be re-recorded, with selected conversation and the reading and recall of three paragraphs on each separate record. The original records were played back until it was definitely established which conversational voice belonged with which reading and recall. (There is no question in the author's mind that this was not satisfactorily accomplished throughout.) From the original conversation was re-recorded five syllables of conversation, reading and recall in each level, pains being taken that only typical passages should be selected.

(2) Three judges with "absolute" pitch were chosen to evaluate the records. Two of the judges were referred to the writer by their professors at the Boston University School of Music on the bases of both their classroom performance and their scores on the Seashore Test of Musical Talent. The third judge volunteered her services,

analyzed conversation is approximately fifteen minutes per

minute of speech.

A second consideration of equal weight in the discussion of how best to analyze the data, was the possibility that a number of factors relating to the speech field might be made if the data were to be treated experimentally as a study in the perception of speech sounds, although it is preferable to some extent the work of Alfred E. Hood.

In view of the above, it was decided that the procedure in analysis would be as follows:

(1) The obtained records were to be re-recorded, with selected conversation and the reading and recall of three sentences on each separate record. The original records were given back until it was definitely established which conversational voices belonged with which reading and recall. (There is no question in the author's mind that this was not satisfactorily accomplished through out.) From the original conversation was re-recorded five syllables of conversation, reading and recall in each level, rather than that only typical sentences should be selected.

(2) Three levels with "syllables" only were chosen to evaluate the records. Two of the tapes were returned to the author by their professors at the Boston University School of Music on the basis of four basic classroom performances and their scores on the Boston University Musical Talent Test. The third tape was returned by the



and her score was found to compare favorably with the scores of the other judges on the Seashore Test. The scores of the judges, for pitch only, are:

Judge 1 - 93

Judge 2 - 89

Judge 3 - 89

(3) Because of the possibility of biased data in the author's selection of typical passages in the re-recording of data, these newer records were not used in the initial judgments, instead, the judges heard once the entire first record, then selected themselves the typical passages to be analysed. From this sentence, a five syllable phrase was chosen as a representative sample of the pitch employed through the selection. This selected passage was played back several times, then the needle of the phonograph was made to retrace successively each syllable or one-syllable word until the judges had either matched the note to a piano (tuned to  $A=440\sim$ ) or judged without recourse to the instrument the pitch of the syllable. After the judges had given the pitch for each of the syllables, the passage was played again.

(4) The method used by each observer in judging the pitch is, perhaps, best told by themselves.

Judge 1

"First I heard the syllable, then I sang the pitch I heard to myself. I know from tonal memory the location of A on the scale, and I related the pitch I was singing to A. In a slide, I first listened for the initial note. Once I heard this, I knew whether the next note or perceptible pitch was

and her score was found to compare favorably with the  
score of the other judges on the separate test. The  
score of the judges, for each only, are:

Judge 1 - 92  
Judge 2 - 93  
Judge 3 - 92

(3) Because of the possibility of biased data in the  
author's selection of typical passages in the re-recording  
of data, these seven records were not used in the initial  
judgment, instead, the judges heard once the entire list  
recap, then selected themselves the typical passages to  
be analyzed. From this sentence, a five syllable phrase

was chosen as a representative sample of the data  
employed through the selection. This selected passage was  
played back several times, then the middle of the phrase  
was made to repeat successively each syllable or  
one-syllable word until the judge had either reached the  
note to a phrase (marked as 1-450) or judged without  
reference to the the present the limit of the syllable.  
After the judge had given the pitch for each of the  
syllables, the phrase was played again.

(4) The rest of each of each observer in judging the pitch  
is, perhaps, best told by themselves.

Judge 1

First, I heard the syllable, then I heard the pitch  
I heard to myself, I took from long memory the  
location of A on the scale, and I related the pitch  
I was giving to A. In a moment, I then listened for  
the second note, when I heard this, I knew  
whether the next note or perceptible pitch was



higher or lower, and whether it was a half or a quarter above or below the semi-tone, as it often was.

### Judge 2

"When you (the author) played the part first, I would pick out the first low note, then the high note. This gave me the limits of the pitch. Then I would listen to the note that kept playing over and over. I compared this with the low note that I first heard. If it was a word with a slide in it, like the first syllable of 'bicycle', I listened for the first pitch in the slide, then when I had this, I could tell how far up the scale the slide went. Sometimes I matched it to the piano, when I was uncertain. After you have listened to a few, though, you can pick out the little shadings of tone quite easily."

### Judge 3

"In the case of unaccented syllables I experienced no difficulty in determining the pitch, but in the accented syllables there was often a tendency for the pitch to slur over several tones before reaching its crest. In these instances, an attempt was made to discriminate the dominant pitch, or if this was impossible, to note the beginning and termination of the slide. These I marked."

The method of Judge 1 is a common one, and although the other judges are not so specific in stating their methods, it remains that each must have a tonal memory of some note, against which they matched the pitch of the syllable under discussion. An attempt to sing the note may result in misplacing the note by an octave, if the observer is feminine, and attempting to analyse a bass voice. The note is observed with accuracy, but the octave depends upon the observer's range. Since, in this investigation, the subjects are all children, and the judges all women whose voices could easily encompass the range exhibited by the children, this difficulty is present, but not to the

higher or lower, and whether it was a half or a quarter above or below the semi-tone, as it often was.

### Judge 2

"When you (the author) played the first first, I would give out the first low note, then the high note. This gave me the limits of the pitch. Then I would listen to the note that kept playing over and over. I compared this with the low note that I first heard. If it was a word with a slide in it, like the first syllable of 'cyclops', I listened for the first pitch in the slide, then when I had this, I could tell how far up the scale the slide went. Sometimes I matched it to the piano, when I was uncertain. After you have listened to a few, though, you can pick out the little shadings of tone quite easily."

### Judge 3

"In the case of unaccented syllables I experienced no difficulty in determining the pitch, but in the accented syllables there was often a tendency for the pitch to rise over several tones before reaching its crest. In these instances, an attempt was made to discriminate the dominant pitch, or if this was impossible, to note the beginning and termination of the slide. These I marked."

The method of Judge 1 is a common one, and although the other judges are not so specific in stating their methods, it remains that each must have a fairly memory of some note, against which they matched the pitch of the syllable under discussion. An attempt to sing the note may result in mistaking the note by an octave. If the observer is feminine, and attempting to analyse a bass voice, the note is covered with accuracy, but the octave depends upon the observer's range. Since, in this investigation, the subjects are all children, and the judges all women whose voices could easily encompass the range exhibited by the children, this difficulty is present, but not to the



extent it might have been had other groups been under discussion.

The process of first choosing a typical passage, hearing the passage several times, hearing the pitch of the single syllables until its pitch was observed with accuracy, then listening to the entire passage once again was repeated seven times for each child in order to establish the average pitch levels of conversation, oral reading of three paragraphs, and the recall from each of these paragraphs.

(4) When the judgments had been collected and tabulated, the agreement between the judges was so close that further investigation to determine the correlation between successive judgments was necessary. This time, each judge met the writer individually. Each was asked to go through the identical procedure, this time, of course, with no recourse to other person's judgments in the event of indecision. The first judge demurred when asked to select again a typical passage, stating that since a five-syllable typical passage had been first selected by the group, it was quite possible that an individual might select another phrase, equally as representative of the entire selection, but one that would contain a different order of tones, thus invalidating any attempted comparison between judgments. The specific syllables upon which judgment for pitch was first obtained were, unfortunately, not written down, hence, it was impossible to later determine exactly which passages in the record had been used. It would have been possible to have

extent it might have been had other factors been under

discussion.

The process of first choosing a typical passage, hearing

the passage several times, hearing the gist of the article

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individually, then was asked to go through the identical

procedure, but this, of course, with no response to other

person's judgments in the event of indecision. The first

judge chosen was asked to select again a typical passage,

reading it twice a five-syllable typical passage had been

first selected by the group, it was quite possible that an

individual might select another phrase, equally as rep-

resentative of the entire selection, but one that would

contain a different order of words, thus favoring any

attempted comparison between judgments. The specific

syllables upon which judgment for which was first obtained

were, unfortunately, not written down, hence, it was

impossible to later determine exactly which passages in the

series had been used. It would have been desirable to have



the judges pick again an average passage, analyse this, then average these pitches and compare them with the averaged pitches of their first judgments. This, however, was thought unwise, since the pitch level varies so slightly for each child from sample to sample, though markedly for the same child in different samples, that any correlation of averaged passages would be, by chance alone, extremely high.

It was largely for the above reason that the author's selections of typical passages, which had already been re-recorded was used. In addition, it had been noted by the author during the first group analysis that the judges were selecting many samples from these records which the author himself had selected, although how many, was at this point undetermined.

When all the judgments had been tabulated, it was found that 90 of the 105 syllables were identical, i.e., 18 out of the 21 passages had been selected by both the author and the group of judges as typical samples. It was then possible to correlate for the re-identification of pitch, as well as for the agreement between judges. These correlations, as well as the complete table of all judgments used in obtaining them are included further on; the table is in the appendix, and the correlations are presented in the "Analysis of Data", which follows immediately.

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the appendix, and the correlations are presented in the  
"Analysis of Data", which follows immediately.



## ANALYSIS OF DATA

RECEIVED



## Analysis of Data

The analysis and description of the data accrued during this investigation is here presented in reference to its chronological acquisition, not to its importance or significance in the present problem. It is for this reason that Chart I, indicating the distribution of reading errors made by the group under discussion is presented first.

The errors indicated in this chart - page 30 - were scored during the reading of the passages, and are broken-down to present both the type of error made in each paragraph, and whenever possible, the frequency of that error. That is, Child 1A made five errors in reading Paragraph 2 - three of which were errors on small words, one was a word insertion, and one related to head movements. Owing to a compression of the chart during the photostating process, the data are not as easily readable as had been expected, although as it stands, it is capable of revealing much of the nature of the reading of this group.

The purpose in making such a chart was two-fold: (1) it was desired to record simply and graphically the errors of each child for each paragraph, and (2) it was desired to indicate the oral reading ability of the group - an ability not specifically measured by the "Metropolitan Achievement Test".

In an effort to further determine if the very small group of fourth graders used in this study be representative

## Analysis of Data

The analysis and description of the data assumed that the investigation is not intended as a reference to the statistical analysis, but to the importance of significance in the present problem. It is for this reason that Table I, indicating the distribution of reading errors made by the group under discussion is presented first.

The errors indicated in this chart - page 28 - were scored during the reading of the passages, and are broken down to present both the type of error made in each paragraph, and wherever possible, the frequency of that error. Table II, Table IA made five errors in reading paragraph 2 - three of which were errors of small words, one was a word insertion, and one referred to a small movement. Owing to a deterioration of the chart during the photostatic process, the data are not as easily readable as had been expected, although as it stands, it is capable of revealing much of the nature of the reading of this group.

The purpose of making such a chart was two-fold: (1) it was desired to record errors and graphically the errors of each child in each paragraph, and (2) it was desired to indicate the reading ability of the group - an ability not specifically mentioned by the "International Achievement Test". In an effort to further determine if the very small group of fourth graders used in this study be representative



# Distribution of Reading Errors Shown by 29 Fourth Grade Pupils on Paragraphs 2-4-6 of Durrell Analysis of Reading Difficulty

Pupil	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013	1014	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029	1030	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045	1046	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061	1062	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077	1078	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093	1094	1095	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110	1111	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126	1127	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142	1143	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158	1159	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174	1175	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190	1191	1192	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207	1208	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1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I. 10110



of an "average" fourth grade, the reading errors were converted into percentages. These percentages are ranked with the percentages obtained from two other investigations<sup>/1</sup> which studied the quality of fourth grade reading by means of the same test paragraphs.<sup>/2</sup> The results of this are shown in Table I, page 32.

At first surveyal, the discrepancies between the three investigations appear rather startling, although the reason for this is soon obvious. Every comment listed by the test author is a subjective comment, and since the criteria for these comments, for instance "occasional phrase reading", is not listed in the studies, it is quite possible that the errors listed by Durrell have been misinterpreted by any one of the three investigators. There is a closer agreement between Burns and Adams than between this investigation and either of the former, indicating both of the other investigators who worked together, had specific, if unlisted, criteria. In this investigation, the criteria for the subjective comments are listed in the appendix.

Pages 33, 34 and 35 (Table II) contain more or less raw data, unrefined by interpretation. The contents, however, are interesting enough and significant enough to warrant the placing of these data here.

/1

Burns, B. "Diagnostic Study of Reading Difficulty in Fourth Grade" Unpublished Master's Thesis, B.U., 1938  
Adams, P. "Study of Individual Differences in Fourth Grade" Unpublished Master's Thesis, B.U., 1938

/2

"Durrell Analysis of Reading Difficulty", Donald D. Durrell  
World Book Company, N.Y. 1933

of an "average" fourth grade, the reading errors were converted into percentages. These percentages are ranked with the percentages obtained from two other investigations which studied the quality of fourth grade reading by means of the same test paragraphs. The results of this are shown in

Table I, page 33.

At first survey, the discrepancies between the three investigations appear rather startling, although the reason for this is soon obvious. Every comment listed by the test author is a subjective comment, and since the criteria for these comments, for instance "occasional phrase reading", is not listed in the studies, it is quite possible that the errors listed by myself have been misinterpreted by any one of the three investigators. There is a closer agreement between Burns and Adams than between this investigation and either of the former, indicating both of the other investigators who worked together, and specific, if undistorted, criteria. In this investigation, the criteria for the subjective comments are listed in the appendix.

Pages 33, 34 and 35 (Table II) contain more or less raw data, unmodified by interpretation. The comments, however, are interesting enough and significant enough to warrant the placing of these data here.

Adams, E. "A Diagnostic Study of Reading Difficulty in Fourth Grade," unpublished Master's Thesis, U. of T., 1933.  
Adams, E. "A Study of Individual Differences in Fourth Grade," unpublished Master's Thesis, U. of T., 1933.  
Adams, E. "A Study of Reading Difficulty," in E. L. Thorndike



Table 1

Showing the Percentage of Reading Errors Reported in This Investigation (C) and Those Reported in the Investigations of Burns (B) and Adams (A)

Reading Error	C	B	A
<u>Phrase Reading</u>			
Word-by-word	.31	.10	.05
Occasional Phrase Reading	.58	.22	.46
Inadequate Expression	.13	.03	.11
<u>Voice, Enunciation, Expression</u>			
Strained, high-pitched voice	.13	.06	.31
Monotonous tone	.21	.14	.41
Inadequate expression	.07		
Volume too loud	.03	.06	.07
Volume too soft	.07		.10
Poor Enunciation-all reading	.07	.28	.02
" " -difficult words	.13	.06	.26
" " - prompted words	.17	.11	.14
Ignores Punctuation	.55	.11	.02
Habitual Repetition	.27	.71	.14
<u>Word Recognition</u>			
Sight vocabulary too small	.10	.01	.05
Errors on smaller words	.93	.35	.58
Word Insertions and Omissions	.58	.50	.34
Ignores wrong pronunciation	.34	.28	.68
<u>General Reading Habits</u>			
Head Movements	.10	.68	.56
Uses finger as pointer	.07		
Tenseness evident	.07	.58	.25
Number	29	143	143







Pitch Ratings of Three Judges on Five Selected Syllables of Conversation and on  
Three levels of Reading and Recall

Judge	Conversation			Reading II			Recall II			Reading IV			Recall IV			Reading IV			Recall IV		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
Record	F'	F'	F'	D#	D#	D#	C#	C#	C#	A#	A#	A#	D#	D#	D#	D#	D#	D#	C#	C#	C#
IA	E'	E'	E'	A#	A#	A#	D#	D#	D#	A#	A#	A#	A#	A#	A#	B.	B.	B.	C#	C#	C#
	E'	E'	E'	A#	A#	A#	B.	B.	B.	A#	A#	A#	A#	A#	A#	A#	A#	A#	A	A	A
	E'	E'	E'	E	E	E	B.	B.	B.	G	G	G	F#	F#	A#	A#	A#	A#	G#	G#	G#
	F'	F'	F'	F	F	F	C#	C#	C#	A#	A#	A#	D	D	D	A#	A#	A#	G#	G	G
IB	D	D	D	D#	D#	D#	B.	B.	B.	B.	B.	B.	C	C	C	C	C	C	D#	D#	D#
	D	D	D	C	C	C	C	C	C	C	C	C	C#	C#	C#	G'	G'	G'	A#	A#	A#
	D	D	D	B.	B.	B.	B.	B.	B.	F.	F.	A#.	C	C	C	G#	A#	G#	D	D	D
	F	F	F	C	C	C	C#	C#	C#	D	D	D	F	F	F	G#	G#	G#	B.	B.	B.
2A	F	F	F	G	G	G	A#	A#	A#	G	G	G	G#	G#	G#	C'	C'	C'	G#	G#	G#
	F	F	F	B.	B.	B.	C#	C	C#	G	G	G	C'	C'	C'	B	B	B	G#	G#	G#
	D	D	D	G	G	G	A#	A#	A#	A	A	A	B	B	B	B	B	B	A#	A#	A#
	C	C	C	E	E	E	A	A	A	G	G	G	B	B	B	G	G	G	A#	A#	A#
3A	D	D	D	C	C	C	E	E	E	D#	D#	D#	G	G	G	D#	D#	D#	B.	B.	B.
	G	G	G	D	D	D	G	G	G	D#	D#	D#	G#	G#	G#	C#	C#	C#	B.	B.	B.
	E	E	E	D	D	D	F#	F#	F#	D#	D#	D#	A	A	A	G	G	G	C#	C#	C#
	F	F	F	D#	D#	D#	F	F	F	C	C	C	A	A	A	F#	F#	F#	D	D	D
3B	F#	F#	F#	D	D	D	D	D	D	C#	D	C#	C#	C#	C#	C	C	C	C	C	C
	F#	F#	F#	D	D	D	B	B	B	A#	A#	A#	C	C	C	A	A	A	B.	B.	B.
	D#	D#	D#	D	D	D	A#	A#	A#	G	G	G	B.	B.	B.	C'	C'	C'	E.	E.	E.
	B.	B.	B.	D	D	D	B	B	B	G	G	G	B.	B.	B.	B	B	B	C	C	C
4A	G#	G#	G#	D#	D#	D#	E	E	E	F#	F#	F#	B.	B.	B.	D	D	D	C	C	C
	G#	G#	G#	D#	D#	D#	A#	A#	A#	F	F	F	C	C	C	D	D	D	B.	B.	B.
	C'	C'	C'	C	C	C	G	G	G	E	E	E	C	C	C	E	E	E	D	D	D
	C'	C'	C'	C	C	C	F	F	F	C	C	C	C	C	C	B.	B.	B.	C	C	C
4B	D	D	D	A	A	A	C#	C#	C#	C#	C#	C#	D#	D#	D#	D#	D#	D#	E	F	F
	B.	B.	B.	A#	A#	A#	C#	C#	C#	D	D	D	D	D	D	E	E	E	E	E	E
	B.	B.	B.	F#	F#	F#	C#	C#	C#	C	C	C	D	D	D	E	E	E	E	E	E
	A	A	A	D#	D#	D#	D#	D#	D#	C	C	C	D	D	D	E	E	E	D	D	D
5A	E	E	E	D	D	D	E	E	E	E	E	E	G	G	G	G	G	G	F	F	F
	G	G	G	E	E	E	C	C	C	G	G	G	D	D	D	G	G	G	G	G	G
	F#	F#	F#	E	E	E	B.	B.	B.	E	E	E	E	E	E	G	G	G	D	D	D
	D	D	D	E	E	E	B.	B.	B.	E	E	E	D#	D#	D#	G#	G#	G#	E	E	E
5B	A	A	A	F#	F#	F#	C'	C'	C'	A#	A#	A#	A#	A#	A#	D#	D#	D#	C'	C'	C'
	G#	G#	G#	G	G	G	B	B	B	A#	A#	A#	B	B	B	D#	D#	D#	A#	A#	A#
	G	G	G	G	G	G	A	A	A	A#	A#	A#	B	B	B	D#	D#	D#	G#	G#	G#
	C	C	C	B	B	B	B	B	B	A#	A#	A#	B	B	B	C#	C#	C#	D	D	D
6A	B.	B.	B.	B	B	B	A	A	A	A	A	A	A	A	A	A#	A#	A#	A#	A#	A#
	A.	A.	A.	A#	A#	A#	A	A	A	G.	G.	G.	F#	F#	F#	B	B	B	G#	G#	G#
	A#	A#	A#	B	B	B	G#	G#	G#	A	A	A	B	B	B	C'	C'	C'	A#	A#	A#
	B.	B.	B.	B	B	B	A	A	A	A#	A#	A#	A	A	A	B	B	B	A#	A#	A#







**Pitch Ratings of Three Judges on Five Selected Syllables of Conversation and on Three Levels of Reading and Recall**

			Conversation			Reading II			Recall II			Reading IV			Recall IV			Reading VI			Recall VI		
Judge	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
Record	G#	G#	G#	D'	D'	D'	D	D	D	D	D	D	F	C#	C#	C#	B	B	B	E	E	E	
6B	A	A	A	E'	E'	E'	A#	A#	A#	A#	A#	A#	F	C#	C#	C#	B	B	B	G	G	G	
	F	F	F	C#	C#	C#	B	B	B	B	B	C#	C#	C#	D	D	D	B	B	B	F#	F#	F#
	G#	G#	G#	D'	D'	D'	A#	A#	A#	A#	A#	C	C	C	C#	C#	C#	B	B	B	F	F	F
	G	G	G	D#	D#	D#	B	B	B	B	B	D	D	D	C	C	C	B	B	B	E	E	E
7A	B.	B.	B.	F#	F#	F#	C	C	C	C	F	F	F	C#	C#	C#	D#	D#	D#	D#	D#	F	
	A.	A.	A.	E	E	E	C#	C#	C#	E	E	E	C	C	C	F	F	F	F	F	F	D#	
	G#	G#	G#	D#	D#	D#	E	E	E	F#	F#	F#	A.	A.	A.	D#	D#	D#	D#	D#	C	C	
	A#	A#	A#	C#	C#	C#	D#	D#	D#	G	G	G	B.	B.	B.	D#	D#	D#	D#	D#	E	E	
7B	B.	B.	B.	F	F	F	C	C	C	C	F#	F#	F#	C	C	C	D#	D#	D#	D	D	D	
	C	C	C	C#	C#	C#	C#	C#	C#	F	F	F	A.	A.	A.	A	A	A	C	C	C		
	B.	B.	B.	A.	A.	A.	B.	B.	B.	B	B	B	B.	B.	B.	A	A	A	D#	D#	D#		
	E	E	E	G	G	G	G#	G#	G#	A	A	A	A	A	A	G#	G#	G#	F	F	F		
8A	D#	D#	D#	G#	G#	G#	A#	A#	A#	A#	A	A	A	B.	B.	B.	G#	G#	G#	B.	B.	B.	
	F#	F#	F#	D	D	D	D	D	D	G#	G#	G#	C	C	C	E	E	E	D	D	D		
	F	F	F	D	D	D	D	D	D	E	E	E	F	F	F	D'	D'	D'	C#	C#	C#		
	E	E	E	F	F	F	F	F	F	B	B	B	E	E	E	D'	D'	D'	D	D	D		
8B	D#	D#	D#	F	F	F	E	E	E	A#	A#	A#	D#	D#	D#	E'	E'	E'	D#	D#	D#		
	D#	D#	D#	F	F	F	E	E	E	A	A	A	E	E	E	C#	D'	C#	D	D	D		
	E	E	E	A	A	A	B.	B.	B.	C	C	C	C	C	C	E	E	E					
	B.	B.	B.	A.	A.	A.	G	G	G	A#	A#	A#	E	E	E	G	G	G	No Recall	No Recall	No Recall		
9A	C	C	C	A#	A#	A#	E	E	E	B.	B.	B.	D	D	D	F#	F#	F#					
	D	D	D	B.	B.	B.	D	D	D	B.	B.	B.	E	E	E	F	F	F					
	C#	C#	C#	B.	B.	B.	D	D	D	B.	B.	B.	E	E	E	E	E	E					
	B.	B.	B.	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	C#	C#	C#	B	B	B		
9B	D	D	D	D	D	D	A.	A.	A.	D	D	D	D#	D#	D#	E'	E'	E'	A	A	A		
	C'	C'	C'	C	C	C	D	D	D	B.	B.	B.	D#	D#	D#	D#	D#	D#	A	A	A		
	D	D	D	F	F	F	D#	D#	D#	F	F	F	D	D	D	F'	F'	F'	A#	A#	A#		
	D	D	D	D	D	D	E	E	E	F	F	F	D	D	D	E'	E'	E'	C'	C'	C'		
10A	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	D#	A.	A.	A.		
	E	E	E	D#	D#	D#	C#	C#	C#	C#	C#	C#	B.	B.	B.	C	C	C	A.	A.	A.		
	D	D	D	D	D	D	C#	C#	C#	C#	C#	C#	A#	A#	A#	B.	B.	B.	D#	D#	D#		
	D	D	D	D	D	D	D	D	D	D	D	D	A#	A#	A#	D	D	D	D#	D#	D#		
10B	C#	C#	C#	F	F	F	D	D	D	D#	D#	D#	D	D	D	G	G	G	C#	C#	C#		
	F#	F#	F#	D#	D#	D#	F	F	F	D	D	D	A	A	A	F#	F#	F#	D#	D#	D#		
	B.	B.	B.	D	D	D	E	E	E	A#	A#	A#	F	F	F	A#	A#	A#	D	D	D		
	C#	C#	C#	B.	B.	B.	D#	D#	D#	G	G	G	D	D	D	B	B	B	B.	B.	B.		
11A	D	D	D	A.	A.	A.	D	D	D	D	D	D	C#	C#	C#	C#	C#	C#	C	C	C		
	B.	B.	B.	E	E	E	C#	C#	C#	C#	C#	C#	D#	D#	D#	D#	D#	D#	D#	D#	D#		
	G#	G#	G#	G	G	G	D#	D#	D#	E	E	E	D	D	D	G	G	G	C#	C#	C#		
	C	C	C	G	G	G	F#	F#	F#	A#	A#	A#	C#	C#	C#	B	B	B	C	C	C		







Pitch Ratings of Three Judges on Five Selected Syllables of Conversation and on  
Three Levels of Reading and Recall

			Conversation			Reading II			Recall II			Reading IV			Recall IV			Reading VI			Recall VI		
Judge	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		
Record	D	D	D	F#	F#	F#	E	E	E	F	F	F	D#	D#	D#	F	F	F	D'	D'	D'		
	B.	B.	B.	A#	A#	A#	C#	C#	C#	C	C	C	B.	B.	B.	D#	D#	D#	C'	C'	C'		
	C#	C#	C#	G#	G#	G#	C#	C#	C#	D#	E'	D#	C#	C#	C#	D	D	D	G	G	G		
	D	D#	D	A	A	A	C#	C#	C#	A#	B	B	D#	D#	D#	G	G	G	F#	F#	F#		
11B	D#	D#	D#	A#	A#	A#	D#	D#	D#	G'	G	E'	D	D	D	G#	G#	G#	F	F	F		
	D#	D#	D	F	F	F	C	C	C	B.	B.	B.	A#.	A#.	A#.	F	F	F	C	C	C		
	A#	A#	A	D#	D#	D#	A#	A#	A#	A#.	A#.	A#.	B.	B.	B.	G	G	G	A#.	A#.	B.		
	A#.	B.	A#.	C	C	C	B	B	B	F	F	F	G#.	G#.	G#.	B	B	B	D#	D#	D#		
12A	G#.	G#.	G#.	D#	D#	D#	D	D	D	G	G	G	A.	A.	A.	A#	A#	A#	F	F	F		
	G#.	G#.	G#.	E	E	E	F	F	F	G#	G#	G#	A.	A.	A.	C'	C'	C'	C	C	C		
	B	B	B	B	B	B	D#	D#	D#	D	D	D	D'	D'	D'	D'	D'	D'	E	E	E		
	E	E	E	D	D	D	C	C	C	B	B	B	B	B	B	B	B	B	D	D	D		
12B	G	G	G	F#	F#	F#	E	E	E	B	B	B	C#'	C#'	C#'	C#'	C#'	C#'	C	C	C		
	G	G	G	A	A	A	G	G	G	B	B	B	D'	D'	D'	B	B	B	A	A	A		
	G#	G#	G#	A#	A#	A#	D#	D#	D#	D	D	D	D'	D'	D'	E'	D#'	E'	C	C	C		
	E	E	E	D#	D#	D#	D	D	D	B	B	B	D	D	D	A	A	A	D	D	D		
13A	D	D	D	D#	D#	D#	D	D	D	B	B	B	D	D	D	A	A	A	C	C	C		
	C#	C#	C#	D	D	D	C	C	C	A#	A#	A#	E	E	E	A	A	A	A	A	A		
	C	C	C	B.	B.	B.	C	C	C	A	A	A	F	F	F	A	A	A	A	A	A		
	B.	B.	B.	D	D	D	C	C	C	B	B	B	E	E	E	A	A	A	D	D	D		
13B	C	C	C	C	C	C	A#	A#	A#	B	B	B	B	B	B	D'	D'	D'	B.	B.	B.		
	D#	D#	D#	G#	G#	G#	B	B	B	A#	A#	A#	A	A	A	D'	D'	D'	A.	A.	A.		
	D	D	D	G#	G#	A	C	C	C	C'	C'	C'	G#	G#	G#	E'	E'	E'	C	C	C		
	C#	C#	C#	G	G	G	D	D	D	C'	C'	C'	G	G	G	B	B	B	C#	C#	C#		
14A	D#	D#	D#	C	C	C	C	C	C	A#.	A#.	A#.	B.	B.	B.	B	B	B	B	B	B		
	B.	B.	B.	D#	D#	D#	A	A	A	C	C	C	F	F	F	A	A	A	G	G	G		
	C	C	C	C	C	C	E	E	E	C	C	C	F#	F#	F#	A	A	A	E	E	E		
	C#	C#	C#	A	A	A	F	F	F	C	C	C	G	G	G	A#	A#	A#	F#	F#	F#		
15A	D	D	D	E	E	E	F#	F#	F#	C	C	C	G	G	G	A	A	A	F	F	F		
	B.	B.	B.	C	C	C	A#.	A#.	A#.	C	C	C	B.	B.	B.	A#	A#	A#	A#	A#	A#		
	A.	A.	A.	D#	D#	D#	G#.	G#.	G#.	A.	A.	A.	E	E	E	B	B	B	C	C	C		
	C	C	C	D	D	D	B.	B.	B.	C	C	C	F	F	F	B	B	B	B	B	B		
15B	C#	C#	C#	D	D	D	A.	A.	A.	C	C	C	F#	F#	F#	B	B	B	A#	A#	A#		
	F	F	F	D#	D#	D#	C	C	C	A.	A.	A.	C	C	C	B	B	B	C	C	C		
	E	E	E	C#	C#	C#	A.	A.	A.	C	C	C	C	C	C	B	B	B	D#	D#	D#		
	D#	D#	D#	C	C	C	A#.	A#.	A#.	B.	B.	B.	A#	A#	A#	B	B	B	D	D	D		
15C	D#	D#	D#	D#	D#	D#	C	C	C	D	D	D	C#	C#	C#	B	B	B	D	D	D		
	F#	F#	F#	B.	B.	B.	D	D	D	C#	C#	C#	D	D	D	C	C	C	B.	B.	B.		
	E	E	E	E	E	E	C	C	C	G#	G#	G#	C	C	C	G	G	G	G#	G#	G#		
	D#	D#	D#	F	F	F	A.	A.	A.	G	G	G	B	B	B	A	A	A	F#	F#	F#		







This table (Table II) indicates the judgments of each of the observers for five syllables, typical of the **entire passage**, from the conversation and from three levels of reading and recall for each child in the investigation. Inspection of this yields many interesting facts.

Perhaps the most interesting of these is the close approximation of the pitches assigned by each judge. Were these judgments all a result of collaboration, this table would not be surprising, but most of these three thousand judgments here presented were given without recourse to either the other observers or to the piano. Possibly in 400 instances did the observers attempt to collaborate or substantiate their opinions in order to verify their judgments of particularly difficult syllables, but in many of these special instances did they find it difficult to hear the pitch described by another observer, and thus, wrote what she heard.

The first record is a result of collaboration throughout, this largely as a practice device. However, this first record, in which much care was exercised in analysis, contains two deviations in judgments. The one is a five semi-tone variance from the pitch described by two judges (A#, two judges, F#, one judge) and the other is one semi-tone from G (as indicated by two judges) to G# (as judged by the third).

Semi-tone deviations are hardly significant, since throughout the analysis, the judges matched pitches to the nearest note, and if, as in this instance, the pitch of the syllable was mid-way between the two notes, it is of

Table II (Table I) indicates the judgments of each of the observers for five episodes, typical of the entire passage, from the conversation and from three levels of reading and recall for each child in the investigation. Inspection of this yields many interesting facts.

Perhaps the most interesting of these is the close approximation of the ratings assigned by each judge. Here these judgments are a result of collaboration, this table would not be surprising, but most of these three thousand judgments were presented and given without recourse to either the other observer or to the pilot. Possibly as 400 instances did the observers attempt to collaborate or

substantiate their opinions in order to verify their judgments of particularly difficult episodes, but in many of these special instances did they find it difficult to reach the same decision on another observer, and here, across what the field. The third record is a result of collaboration between this largely as a pilot or observer. However, this third record in which two data are obtained in analysis, contains two

deviations in judgments. The one is a five-card-long variation from the data described in two judges (A, two judges, B, one judge) and the other is one card-long from B as indicated by two judges) to C (as judged by the third).

Small-time deviations are hardly significant, since throughout the analysis, the judges related pictures to the present notes, and it, as in this instance, the order of the analysis was different from the two notes. It is of



little import that one assigned the pitch to A# instead of A. The first deviation of five semi-tones cannot be dismissed so easily. This is undoubtedly significant, though the cause is not so apparent. It may have been that a memory of the past syllable (A#) produced the effect of a repetition of the same note - possibly the hallucination effect mentioned by Scripture as an attendant difficulty upon the analysis of speech by auditory methods. It is possible, also, that fatigue diminished the observer's acuity, but despite the cause, the fact remains that each judge heard the note she described, and could not, in this instance, hear the pitch indicated by the judges who differed in opinion.

After this first record the collaboration or conversation diminished considerably, and thus, by the seventh record, general comparison was negligible. Since no attempt was made to force the judges to remain silent, and they could feel free to ask for other opinions if they so desired, these data cannot be treated as independent observations.

The pitch patterns employed by the children, and as revealed through these judgments, is a complete study in itself, though not here treated. It is interesting to note that in general the children employ the tones of an augmented C major chord in their conversation, while in their reading, most markedly in Paragraph 6, the pitch deviates in each instance so radically from a formal pattern that to assign a major or minor chord as predominant would be arbitrary.

little input that one assigned the pitch to A instead of A.  
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Scribner as an attendant difficulty upon the analysis of  
speech by auditory methods. It is possible, also, that fatigue  
diminished the observer's acuity, but despite the cause, the  
fact remains that each judge heard the note as described,  
and could not, in this instance, hear the pitch indicated by  
the judges who differed in opinion.

After this first record the collaboration or conversation  
disappeared completely, and thus, by the seventh record,  
general comparison was negligible. Since no attempt was made  
to force the judges to remain silent, and they could feel  
free to ask for other opinions if they so desired, these data  
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The pitch patterns employed by the children, and as  
revealed through these judgments, is a complex study in  
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that in general the children employ the tones of an augmented  
C major chord in their conversation, while in their singing,  
most markedly in Paragraph 6, the pitch deviates in each  
instance so radically from a formal pattern that to assign  
a major or minor chord as predominant would be arbitrary.



In Paragraph 6 we have tonal patterns that when played are grating to the ear, and patterns that employ great skips in octaves, and frequent unpleasant changes from harmonic to non-harmonic effects. It is indicated in these very small samples of five syllables, that the nearer the voice follows a harmonic melody curve, the less difficult or more pleasing is the speaking, an observation which is substantiated by those of Dionysius of Halicarnassus and Charles A. Woolbert.

Table III presents the seven correlation coefficients for the three judges in the analysis of 90 running syllables of speech. One hundred and five such syllables were originally analysed, but in three instances, different average passages were chosen (as is explained in Chapter II). The differences between average passages in these fifteen syllables were not great differences in pitch, but were marked differences in the order of assigned pitches, hence, when included in the correlations, the true coefficient was considerably distorted. For this reason, those selections for which different representative passages were chosen are here omitted, and the correlation coefficients are presented only for those pitches which each observer judged twice, once with a group, and once individually.

It may be here mentioned that because of the method used (pearson Product-Moment) in obtaining the correlations, the coefficients suffer, since in many instances a correct judgment could have been made to either the semi-tone above or below the note finally indicated as the correct pitch.

In Figure 1 we have some patterns that were played and given to the ear, and patterns that employ great shifts in octave, and frequent displacement changes from harmonic to non-harmonic effects. It is indicated in these very small samples of five syllables, that the nearer the voice follows a harmonic melody curve, the less difficult or more pleasing is the speaking, an observation which is substantiated by those of phonetics of Harnad and Charles A. Wootton.

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It may be here mentioned that because of the method used (Pearson Product-Moment) in obtaining the correlations, the coefficients suffer, since in many instances a correct judgment could have been made as either the right-hand score or below the score finally indicated as the correct pitch.



Table III

## Correlation Coefficients\*

## A. Correlation of Judges 2 and 3 with 1 (Group Judgment)

Judge 2:  $r = .99 \pm .007$ Judge 3:  $r = .99 \pm .007$ Mean  $r = .99$ 

## B. Correlation of Judges 2 and 3 with 1 (Individual Judgment)

Judge 2:  $r = .63 \pm .04$ Judge 3:  $r = .81 \pm .02$ Mean  $r = .72$ 

## C. Correlation of Judges on Re-identification of Pitch

Judge 1:  $r = .80 \pm .02$ Judge 2:  $r = .65 \pm .04$ Judge 3:  $r = .70 \pm .03$ Mean  $r = .72$ 

\* for the complete list of data from which these correlations were obtained, see Appendix, pages vii and viii.

## Table III

## Correlation Coefficients

## A. Correlation of Judges 1 and 2 with 1 (Group Judgment)

Judge 1:  $r = .93 \pm .007$   
 Judge 2:  $r = .93 \pm .007$

Mean  $r = .93$

## B. Correlation of Judges 1 and 2 with 1 (Individual Judgment)

Judge 1:  $r = .93 \pm .04$   
 Judge 2:  $r = .91 \pm .03$

Mean  $r = .92$

## C. Correlation of Judges on Re-identification of Fish

Judge 1:  $r = .89 \pm .03$   
 Judge 2:  $r = .85 \pm .04$   
 Judge 3:  $r = .79 \pm .03$

Mean  $r = .84$

\* For the complete list of data from which these correlations were obtained, see Appendix, pages vii and viii.



Thus, if a note was matched to a natural in the first analysis, and to a sharp in the second analysis - either of which may have been correct - a lowered correlation is the result. This observation holds true for all the correlations, re-identification of pitch as well as for the correlation between judges. It may have been possible to use a different formula to obtain the correlations, but since previous studies utilized the Pearson Product-Moment, with a step interval of one semi-tone (assuming the mid point at the note) it was thought best to follow a similar plan here.

As a standard against which to correlate the judgments of the observers, it was though wise to use the judgments of that observer scoring highest on the Seashore Test (Judge 1). This is, of course, no indication that her judgments were infallible, and it is possible, though undetermined, that in many instances the exact pitch of the syllable was that recorded by the other observers, or perhaps by none of the observers. However, this was the only criterion readibly available, and so was used.

The correlations listed under A - the correlation between the judges on their first analysis - is almost unbelievably high, .98 for both judges. It was because of this remarkable correlation that further investigation was undertaken, although we are assuming that the coefficient for the entire three thousand judgments is not so high.

A partial explanation for this unusual correlation may lie in the sample selected. Records number 1B, 4A and 9B

Thus, if a note was matched to a natural in the first analysis, and to a shift in the second analysis - either of which may have been correct - a lowered correlation is the result. This observation holds true for all the correlations, re-identification of pitch as well as for the correlation between judges. It may have been possible to use a different formula to obtain the correlations, but since previous studies utilized the Pearson Product-Moment, with a zero interval of one semi-tone (assuming the mid point at the note) it was thought best to follow a similar plan here.

As a standard against which to correlate the judgments of the observers, it was thought wise to use the judgments of that observer scoring highest on the Beachcroft Test (Judge 1). This is, of course, no indication that her judgments were infallible, and it is possible, though undetermined, that in many instances the exact pitch of the syllable was that recorded by the other observers, or perhaps by none of the observers. However, this was the only criterion readily available, and so was used.

The correlations listed under A - the correlation between the judges on their first analysis - is almost universally high. .98 for both judges. It was because of this remarkable correlation that further investigation was undertaken, although we are assuming that the coefficients for the entire three thousand judgments is not so high.

A partial explanation for this initial correlation may

lie in the sample selected. Records number 14, 15 and 16



were used for re-analysis, and hence, for all the correlations because a casual inspection revealed that these three possessed a wide range of pitch, and were so spaced in the order of analysis that for each successive record there was a diminishing collaboration. Further criteria, unfortunately, were entirely capricious.

This mean correlation of .98 exceeds Root's correlation by a considerable difference ( $\neq$  .03, which at the upper limits is approximately as great as the difference between two correlations of .01 and .71). However, these two studies may not be directly compared, because in these samples there is always present a varying degree of collaboration between judges, while in Root's investigation, none was permitted.

In direct comparison with the above correlation, we have that obtained on the same syllables, analysed this time entirely individually. (B - the correlation of Judges 2 and 3 with Judge 1, individual judgments) Here, instead of a mean correlation of .98, which conceivably could have been expected again, we have a mean correlation of .72, or a lowering of the mean by twenty-six points. It may be here admitted that the author is somewhat at a loss to account for this. With two of the records in the first analysis there was, of course, an appreciable amount of discussion among the judges, but the practice effect should have compensated for this deprivation of opportunity for consultation. Obviously, it did not.

Our discussion, then, narrows down to this: on two successive correlations between the same judges in the

were used for re-analysis, and hence, for all the correlations because a causal hypothesis revealed that these three possessed a wide range of pitch, and were so spaced in the order of analysis that for each successive record there was a diminishing collaboration. Further criteria, unfortunately, were entirely capricious.

This mean correlation of .98 exceeds Hoot's correlation by a considerable difference ( $\frac{1}{4}$ .05, which at the upper limit is approximately as great as the difference between two correlations of .01 and .01). However, these two studies may not be directly compared, because in these studies there is always present a varying degree of collaboration between judges, while in Hoot's investigation, none was permitted. In direct comparison with the above correlation, we have

that obtained on the same syllables, analyzed this time entirely individually. (5 - the correlation of Judges 2 and 3 with Judge 1, individual judgments) Here, instead of a mean correlation of .98, which conceivably could have been expected again, we have a mean correlation of .75, or a lowering of the mean by twenty-six points. It may be here added that the author is somewhat at a loss to account for this. With two of the records in the first analysis there was, of course, an appreciable amount of discussion among the judges, and the practice effect might have compensated for this deviation of opportunity for collaboration. Obviously, it did not. Our discussion, then, narrows down to this: on two successive correlations between the same judges in the



analysis of the same syllables of speech, one of which was with a group, and one entirely individually, why should there be a lowering of the mean correlation by twenty-six points?

The only possible explanations for this are: (1) - as indicated just above - an unsuspected amount of collaboration between the judges took place, or (2) Judge 1, against whose opinions the judgments of the other observers were evaluated in both instances, was not so accurate on her judgments the second time as she was the first. She could still score the highest for re-identification, yet be far below her previous average. Fatigue, illness -especially a cold which would lessen her auditory acuity - lack of interest or the necessity for haste might account for this.

These two explanations are offered; it is desired that neither be assumed to account in entirety for this discrepancy; and it is possible that both play some role in the explanation.

To obtain the correlation for the re-identification of pitch (C), the second judgment of pitch for each observer was correlated with the observer's first judgment on the same syllable. The highest correlation, it will be noticed, is that of Judge 1, who had the highest score on the Seashore Test.

Judges 2 and 3, who had identical scores (89) rank far below Judge 1 on the reidentification of pitch; Judge 3 ranks .10 less than Judge 1, and Judge 2 ranks .15 less.

The deviations between the two successive judgments are not so much the expected semi-tone deviations, but rather

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Judges 2 and 3, who had identical scores (88) rank far below Judge 1 on the re-identification of pitch; Judge 2 ranks 10 less than Judge 1, and Judge 3 ranks 15 less. The deviations between the two successive judgments are not so much the expected semi-range deviation, but rather



differences of twelve, seven and nine semi-tones. The twelve tone deviations (or one octave) may be accounted for more easily than seven and nine tone deviations, for it seems probable that this misplacing of a note by an octave indicates the judge sang the pitch she was attempting to analyse, and although located the note, misplaced the octave. However, if we assume for a judge the tonal memory of A, a seven semi-tone deviation (viz., a first judgment of G# and a second of C) is indeed difficult to explain.

For C, the mean correlation on re-identification of pitch is .72. In view of the nature of the data, and the difficulties attendant upon the analysis of speech sounds by the ear alone, this correlation, the author feels, indicates an agreement that is above that of mere chance, thus satisfactory for the purposes of this study.

None of the correlations are as high as those obtained by Root, (except the correlation of judgments obtained in the group analysis) but differences in procedure, selection of judges, and other factors probably explain many of the disparities. The use of a reed organ against which the pitch of the syllable was matched, the use of commercial records, which are relatively free from noise, and the small interval of time used in each analysis ( $\frac{1}{2}$  hour sittings) undoubtedly contribute to no small degree in raising Root's correlations many points above the correlations secured in this study. In addition, Root differentiated between dominantly perceived pitch, and those pitches more elusive to identify, presenting

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None of the correlations are as high as those obtained by Foot, (except the correlation of judgments obtained in the group analysis) but differences in procedure, selection of judges, and other factors probably explain many of the disparities. The use of a good organ against which the pitch of the syllable was matched, the use of recorded records, which are relatively free from noise, and the small interval of time used in each analysis (1/2 hour intervals) undoubtedly contribute to no small degree in raising Foot's correlations. Many points above the correlations secured in this study. In addition, small differences between judgments persisted, and these differences were relative to identity, magnitude



separate correlations for each. Hence, it is only possible to here indicate that a difference between the two studies does exist, the exact difference in terms of correlation points must remain undetermined.

The mean correlations throughout were obtained by the method outlined by Garrett<sup>/1</sup>, which requires the squaring of each correlation, averaging the squares and extracting the square root in order to obtain the mean. With the present correlations, the arithmetic average yields no difference.

It must not be assumed from the above that the author is completely satisfied with the obtained correlations, nor that he feels his explanations of great disparities between judges and judgments is adequate. Quite the contrary is true, for one correlation is too high to compare directly with previous investigations, another too low, and the third but indicative that its' use in this study must be limited. The explanations of many of these phenomena is completely beyond the ken of the author, who has but briefly suggested possible causes, no one of which may be accepted as final. However, the data stands as obtained, and is used through necessity - though with caution - as the only foundation upon which to base any conclusions.

From the analysed samples of Table II, pages 33-35, was taken the average pitch levels of the entire group for the conversation and the three levels of reading and recall. The

<sup>/1</sup>

Garrett, H.E. Statistics in Psychology and Education  
2nd edition, Longmans Green Company, N.Y. 1938, p.284

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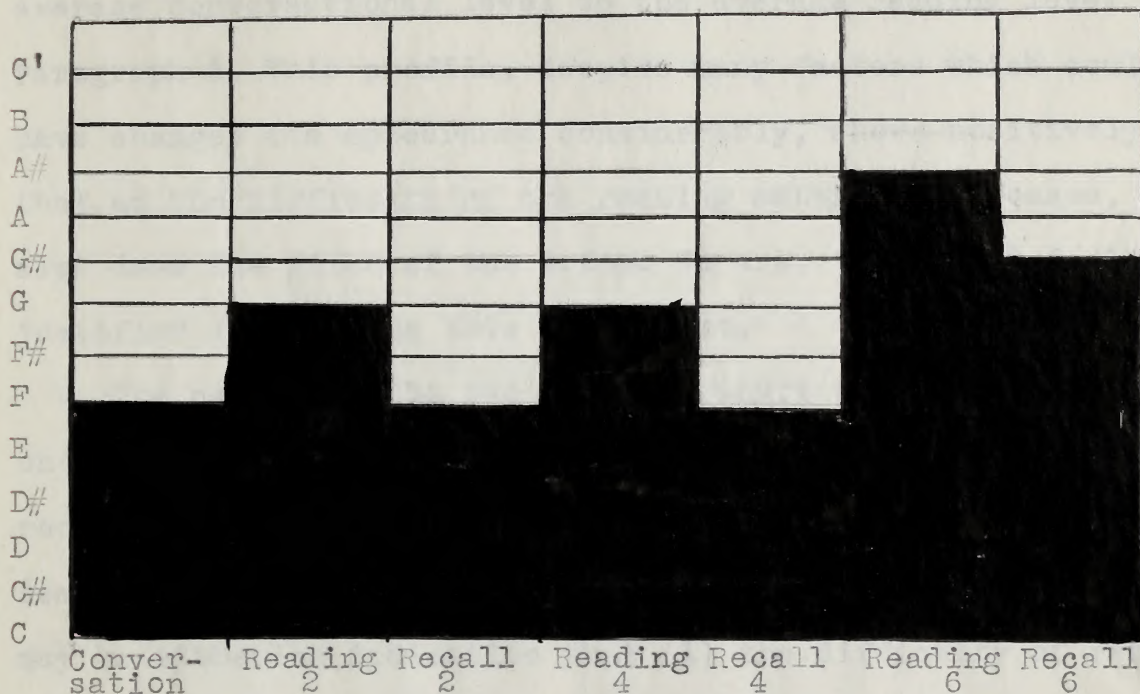
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From the analysis samples of Table II, pages 33-35, was  
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Figure I

Average Pitch Levels of 29 Fourth Grade Pupils in Conversation and Oral Reading of Three Paragraphs of the "Durrell Analysis of Reading Difficulty"

Figure II

Average Pitch Levels of 11 Fourth Grade Pupils in Conversation and Oral Reading of Paragraphs #2,4,6 of the "Durrell Analysis of Reading Difficulty" (in order named)

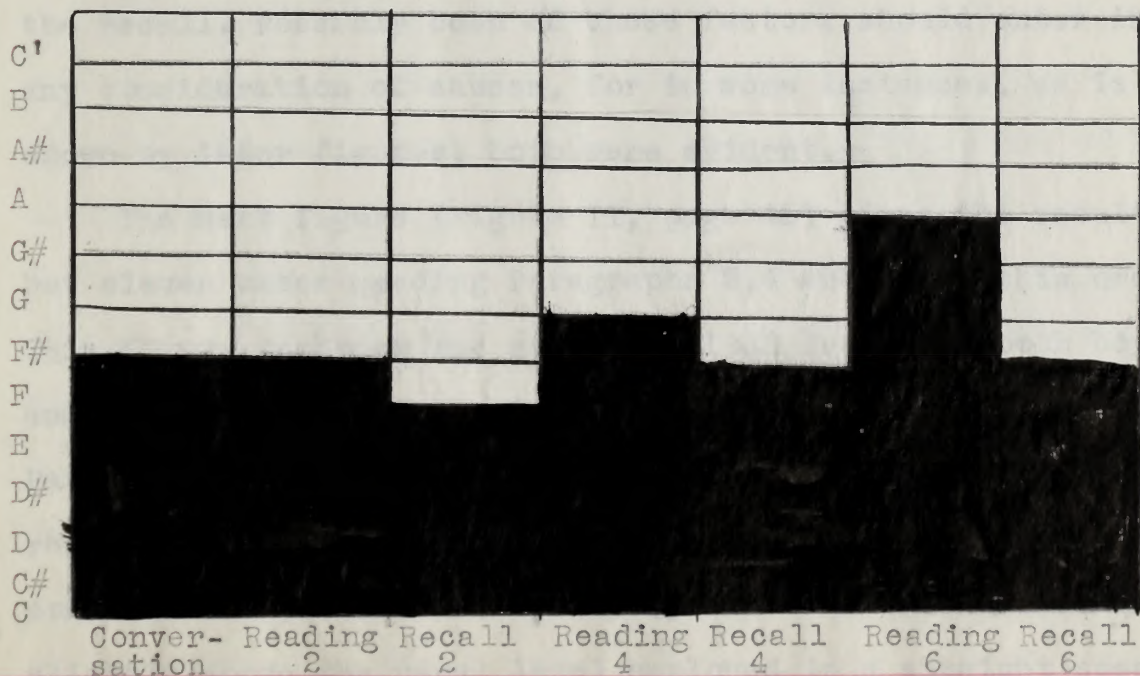


Figure 1  
Average Pitch Levels of 29 South Grade Pupils in Conversation  
and Total Reading of Three Paragraphs of the "Murrell Analysis"  
of Reading Difficulty

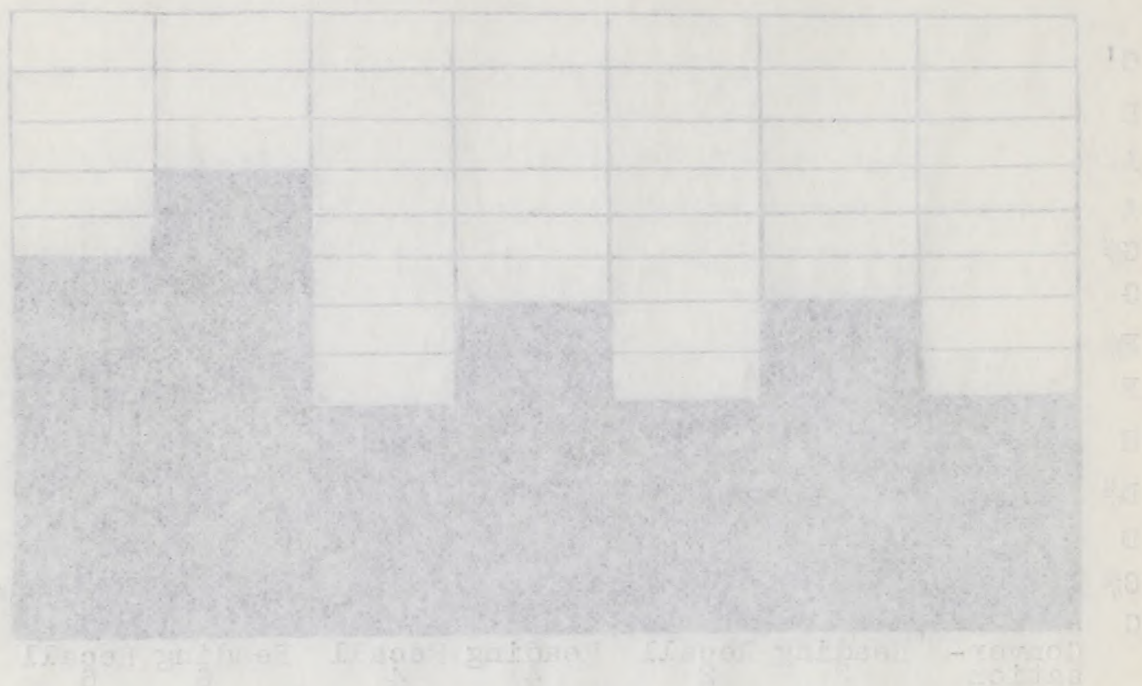
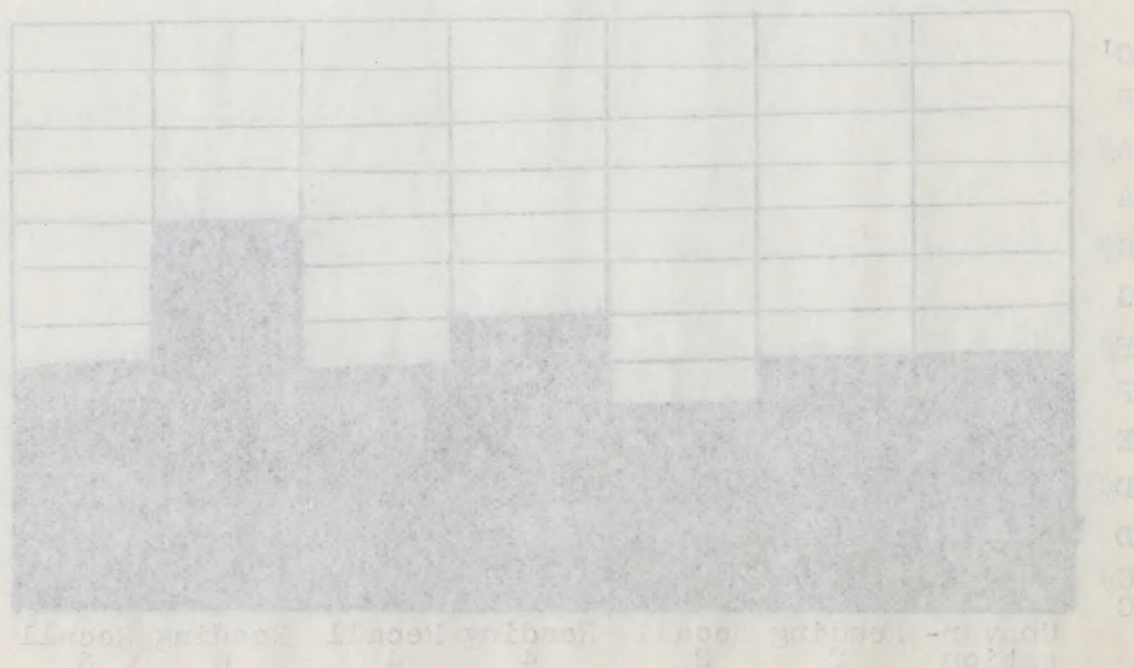


Figure 2  
Average Pitch Levels of 11 Fourth Grade Pupils in Conversation  
and Total Reading of Paragraphs 2, 4, & 6 of the "Murrell Analysis"  
of Reading Difficulty (in other words)





results of this may be seen in Figure I, page 45. There is, this shows, a gradual but well marked raise in pitch from the average conversational level to the average reading level of Paragraph 6. This profile, despite many factors which could have changes its appearance considerably, shows positively that as the difficulty of the reading material increases, so also does the pitch of the voice. We are, the author feels, justified in assuming this throughout.

The recall of the two less difficult paragraphs remains on the conversational level, naturally enough, although the recall of the sixth paragraph assumes a pitch level three semi-tones above that employed for any other recall. This may be either an indication that (1) the difficulty of recalling the ideas expressed in difficult reading material results in a heightened pitch, or (2) high pitch in the reading of difficult material results in the transfer of this pitch to the recall. Possibly both of these factors should enter into any consideration of causes, for in some instances, as is shown by later figures, both were evident.

The next figure (Figure II, page 45) gives the results of but eleven cases reading Paragraphs 2, 4 and 6, in this order. This figure includes the averaged pitch levels of both boys and girls. It is interesting to note that the recall of Paragraph 2 dropped one semi-tone below that of either the reading or the conversation, which indicates that the conversation of some - or possibly all - of the children was slightly above the usual level employed in a straight speaking

results of this may be seen in Figure 1, page 48. There is, this shows, a gradual but well marked rise in pitch from the average conversational level to the average reading level of paragraph 6. This is due, despite many factors which could have changed the suprasegmental considerably, shows positively that as the difficulty of the reading material increases, so also does the pitch of the voice. As yet, the further tests, limited in number, this experiment.

The results of the two tests of different paragraph levels on the conversational level, naturally enough, although the recall of the sixth paragraph showed a higher level than semi-learned above that employed for any other recall. This may be either an indication that (1) the difficulty of recalling the ideas expressed in different reading material results in a heightened pitch, or (2) high pitch in the reading of difficult material results in the transfer of this pitch to the recall. Possibly both of these factors should enter into any consideration of course. For in some instances, as is shown by later figures, both were evident.

The next figure (Figure 11, page 50) gives the results of but eleven cases reading paragraphs 5, 4 and 3, in this order. This figure indicates the average pitch levels of each boy and girl. It is interesting to note that the recall of paragraph 5 showed the semi-learned level just as after the reading of the conversation, which indicates that the conversation of some - or possibly all - of the children was slightly above the usual level employed in a difficult reading



situation. Every effort was made to have the situation as normal as possible, although with a laboratory experiment of this type, in which children are employed to obtain average conversational levels of pitch, deviations of this sort may well be expected. The pitch pattern follows in general that obtained for the average level of the group.

When the order of the paragraphs is changed but slightly, as is shown in Figure III (Page 48) presenting the 4th grade level paragraph first, next, the 2nd grade paragraph, and finally the 6th grade paragraph, a smoothing out of the pitch profile is evident. (If comparing directly any two figures, it must be born in mind that the conversational levels may vary, permitting the profiles to be discussed only in terms of semi-tones above or below the obtained conversational level.) By allowing the child to read first the 4th grade paragraph, the pitch was increased three semi-tones over his conversational level - an increase that is equalled, but not exceeded by, the pitch used in the reading of the most difficult material. It may be assumed here that the strangeness of the situation, and other factors discussed below, played an important part with this group in their reading. The pitch level on recall of Paragraph 4 drops back again three semi-tones, though it increases by one semi-tone when reading Paragraph 2. Explanations for the above are not readily evident, but it is known that the children of the group were expecting to read and recall two paragraphs of increasing difficulty. If they succeeded in this, they could be allowed to read a still

attention. Every effort was made to have the attention as general as possible, although with a laboratory experiment of this type, in which children are required to do in average conversational levels of speech, deviations of this sort may well be expected. The slight behavior follows in general that obtained for the average level of the group.

From the order of the paragraphs it should be evident, as is shown in Figure 1 (page 43) illustrating the 4th grade level paragraph (1st, next, the 2nd, 3rd paragraph, and finally the 4th grade paragraph, a recording one of the 4th grade, it is evident. (It appears directly one two figures, it must be born to mind that the conversational level is very, particularly the position to be discussed only in terms of each-ones above or below the obtained conversational level.) By looking the child to read first the 4th grade paragraph, the child was instructed three semi-ones over the conversational level - an increase that is small, but not exceeded it. The child used in the reading of the most difficult material. It may be assumed here that the irregularity of the situation, and other factors disturbed before, which is important with this group in its reading. The 4th grade level on level of paragraph 4 took back again three semi-ones, though it increased by one semi-one when reading paragraph 5. Explanations for the above are not readily evident, but it is known that the children of the group were expected to read the 4th grade paragraph of increasing difficulty. It was expected that the child would be able to read the 4th



Figure III

Average Pitch Levels of 10 Fourth Grade Pupils in Conversation and Oral Reading of Paragraphs #4,2,6 of the "Durrell Analysis of Reading Difficulty" (in order named)

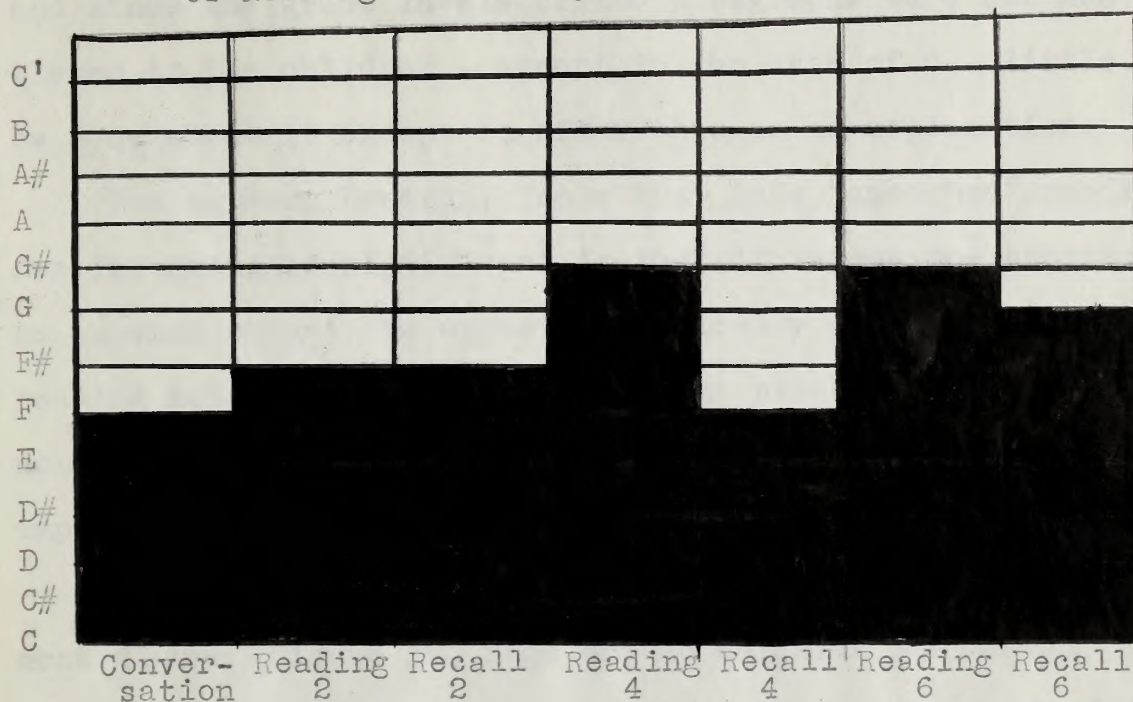


Figure IV

Average Pitch Levels of 8 Fourth Grade Pupils in Conversation and Oral Reading of Paragraphs 6,2,4 of the "Durrell Analysis of Reading Difficulty" (in order named)

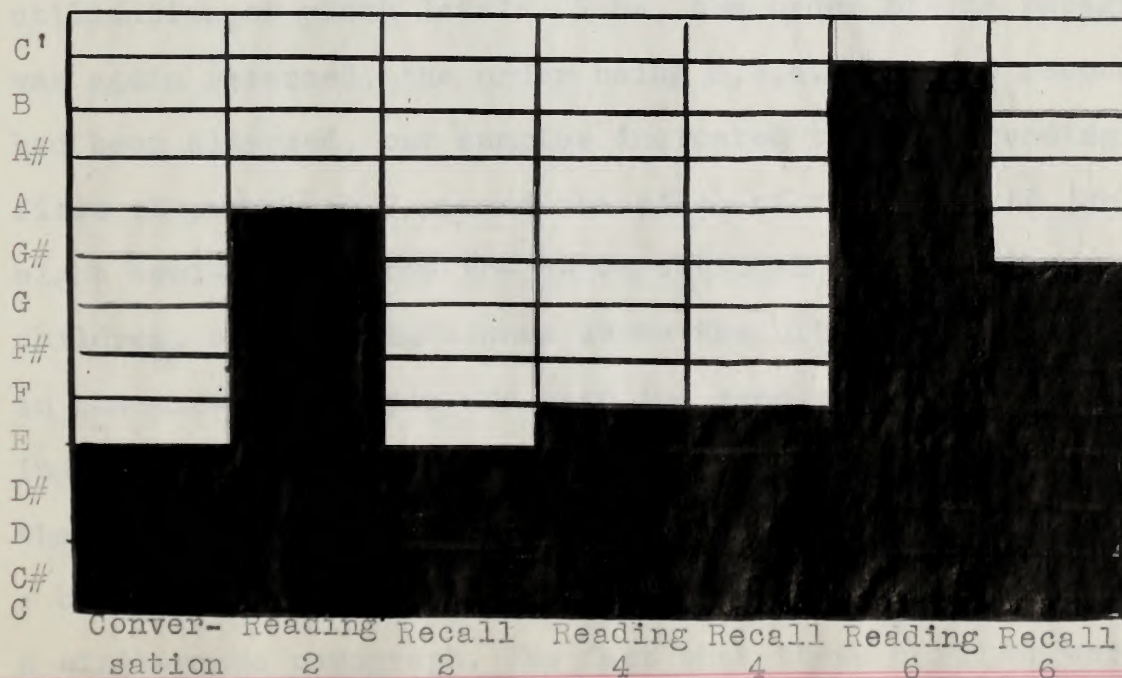


Figure III  
Average level of 10 South Grade Profile in Duverson  
and level of "Tweety" (in other words)  
of "Tweety" (in other words)

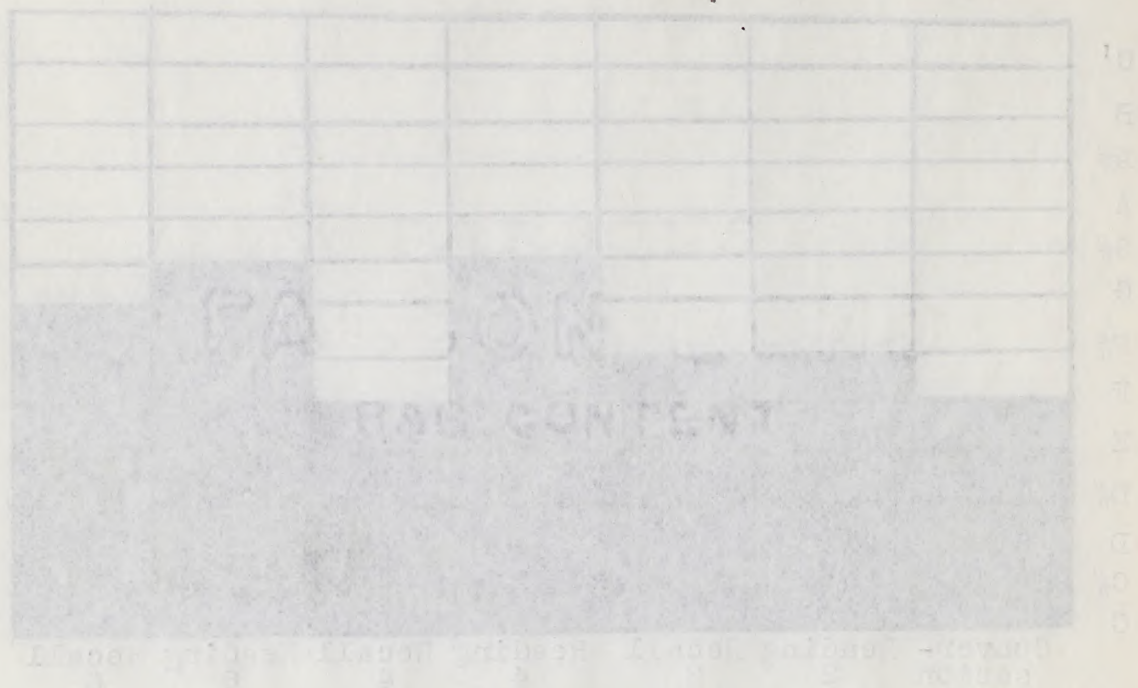
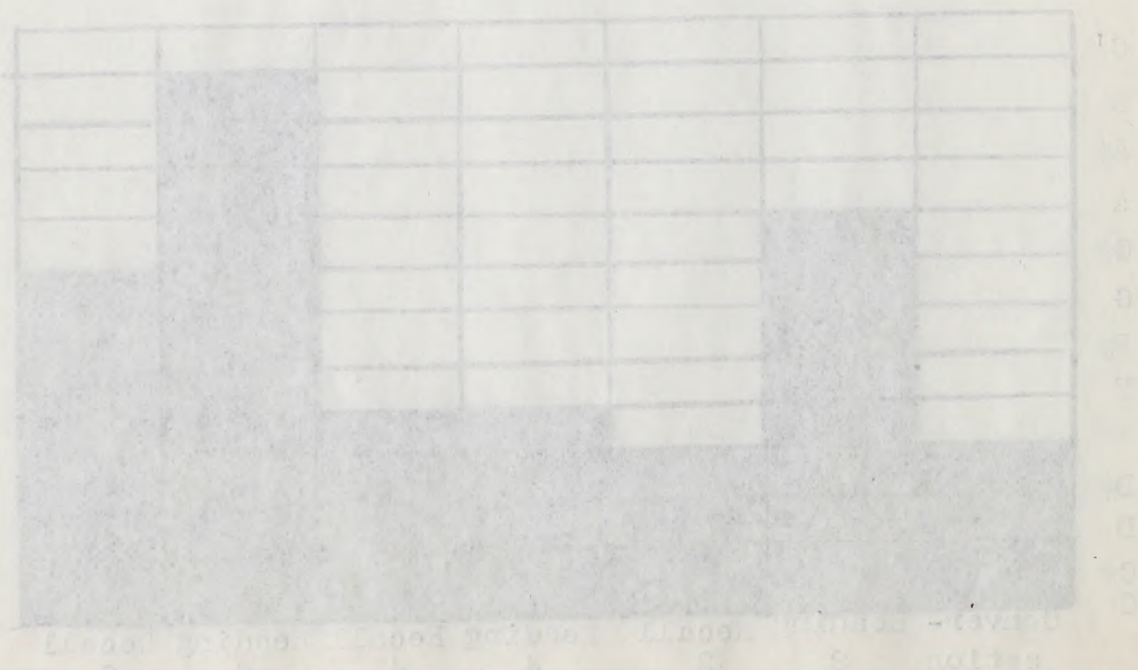


Figure IV  
Average level of 10 South Grade Profile in Duverson  
and level of "Tweety" (in other words)  
of "Tweety" (in other words)





more difficult passage. A consultation with the home room teacher disclosed this after the conclusion of the experiment, and since the grade levels of the paragraphs were not mentioned to the children - except in the case of 6 - little can be done about it except to offer this as an explanation.

The author, however, feels that this "smoothed" profile for the group is significant in that it raises the question as to what extent the expected difficulty or simplicity of reading material is reflected through pitch. The answer can not here be given, but it is indicated that it may be an important consideration in the analysis of data.

Because there were but eight children represented in the next figure (Figure IV, page 48) no definite statements can be made on this profile, which is the most interesting obtained from this investigation, in that it points directly to the fact that habit plays a very important part in the utilization of pitch levels. Here, the order of the paragraphs was again reversed, the order being 6,2,4. When our records had been analysed, our samples indicated that the reading first of paragraph 6 caused the pitch of the voice to jump eight semi-tones above the conversational level of these children, or four semi-tones above the pitch used by the children in the previous sample who read the same paragraphs, although in different order. This is not a chance increase, nor were these children any less bright than the others, indicating a biased comparison. These children knew they were first reading a sixth-grade paragraph. The fact that these children were

immediately turned into difficult reading is the best explanation of the unusual pitch level herein employed. As explained in Chapter II, the motivation for this group was a little unfortunate, since the group was particularly anxious to read the hard paragraph, but it remains that initial reading of difficult material, in addition to unfortunate motivation, causes an appreciable rise in the pitch of the speaking voice.

The definite transfer of habit can be noted by observing the obtained pitch levels of the reading of Paragraph 2. Here is another increase, this time of 5 semi-tones - the greatest for this paragraph in the study - that cannot be accounted for by chance, nor motivation, nor by any factor except the positive transference of the pitch used in difficult reading into the pitch used for very simple reading. Stated again, this figure indicates that the reading of a difficult passage with a high pitch results in a continued high pitch even when simpler material follows immediately. It would be fruitless to attempt to correlate anything about habit patterns in pitch from this sample, but the indications are strong that heightened pitch in all reading may be caused by starting the child with difficult reading material, and if the child continues to read in this manner, a habit may be built up which would persist even when the child is fully capable of advanced reading material. This needs further investigation.

The pitch level employed in Paragraph 4 is again unusual. For after the child had recalled the material from Paragraph 2



2 in his natural conversational tone, his reading for this paragraph on this grade level increased in pitch but one semi-tone, an increase which remained constant for the recall, as well. This is another instance which supports the habit theory, mentioned before. After once the child had assumed his natural pitch level, his reading did not increase but slightly for that material of which he was capable of complete mastery.

Figures V and VI, page 52, may here be discussed together, since they present the pitch levels of children scoring above and below grade 4-7 on the "Metropolitan Test". The profile is presented irrespective of the order of the paragraphs read, but not-with-standing, indicates a significant difference to the effect that poor readers use a relatively higher pitch throughout all reading than do better readers, the pitch growing progressively higher as the difficulty of the material increases, The less capable readers show a three semi-tone increase over their conversational level in Reading 2, to an 8 semi-tone increase in Reading 6, as compared with the better readers who show a pitch increase of two semi-tones over their conversation for Reading 2 to but three semi-tones for Paragraph 6.

Figures VII and VIII indicate the levels of boys as contrasted with girls. - this, as in the previous figures, not taking into consideration the order of the paragraphs, nor the scores on the "Metropolitan Test". The boys show little difference (less one semi-tone) from the girls in conversation.

is in his normal conversational range, his reading for this paragraph on this grade level increased in pitch but not in volume, an increase which remained constant for the recall, as well. This is another instance which supports the habit theory, mentioned before. After once the child had learned his normal pitch level, his reading did not increase but slightly for that material of which he was capable of complete mastery.

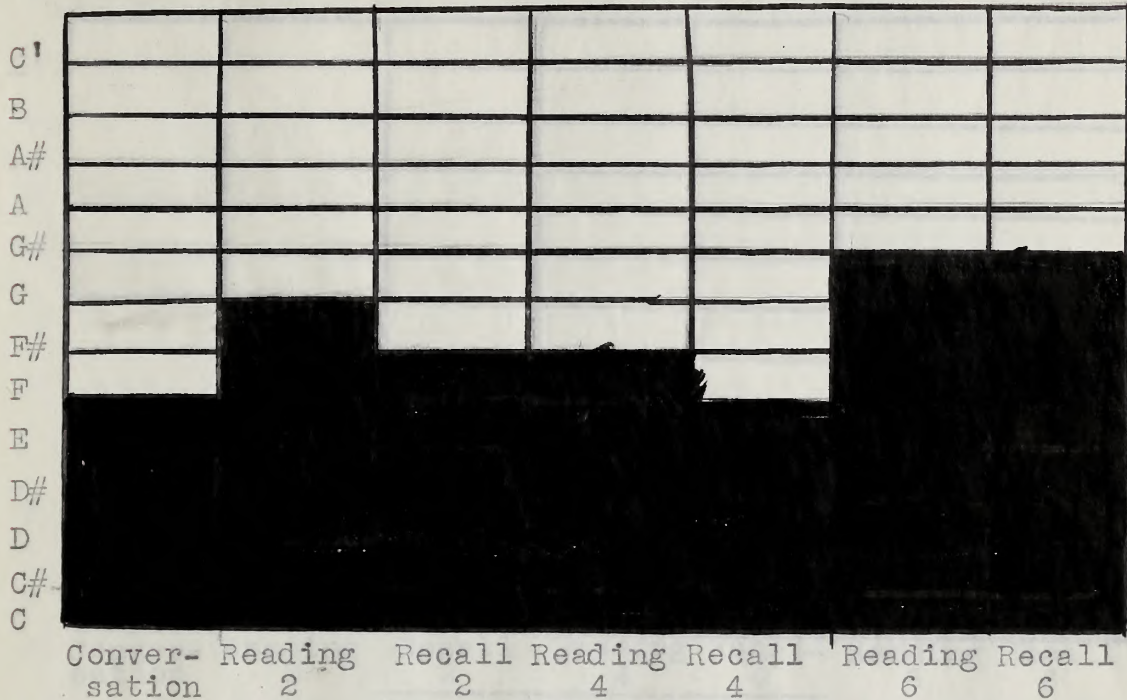
Figures V and VI, page 32, may have been discussed together, since they present the pitch levels of children scoring above and below grade 4-V on the "Metropolitan Test". The results are presented respectively in the order of the paragraphs read, but not withstanding, indicates a significant difference in the effect that poor readers use a relatively higher pitch throughout all reading than do better readers, the pitch growing progressively lighter as the difficulty of the material increases. The less capable readers show a three semi-tone increase over their conversational level in reading 2, to an 8 semi-tone increase in reading 6, as compared with the better readers who show a pitch increase of two semi-tones over their conversational for reading 2 to but three semi-tones for passage 6.

Figures VII and VIII indicate the levels of boys as compared with girls - this, as in the previous figures, not taking into consideration the order of the paragraphs, nor the scores on the "Metropolitan Test". The boys show little difference (less one semi-tone) from the girls in conversational,



Figure V

Pitch Profiles of 16 Readers Scoring Above Grade 4-7 on the "Metropolitan Achievement Test" (profile irrespective of the order of the paragraphs)

Figure VI

Pitch Profiles of 13 Readers Scoring Below Grade 4-7 on the "Metropolitan Achievement Test" (profile irrespective of the order of the paragraphs)

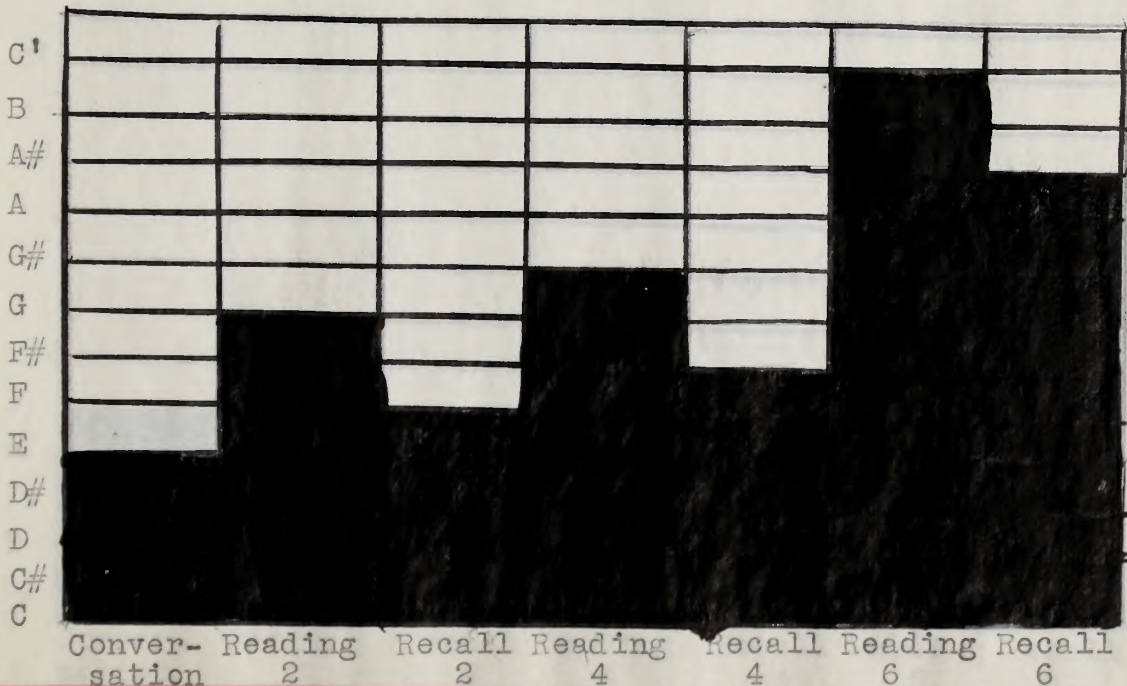




Figure V

Figure V shows the results of the tests of the "Metropolitan Achievement Test" (profile) for the order of the paragraphs.

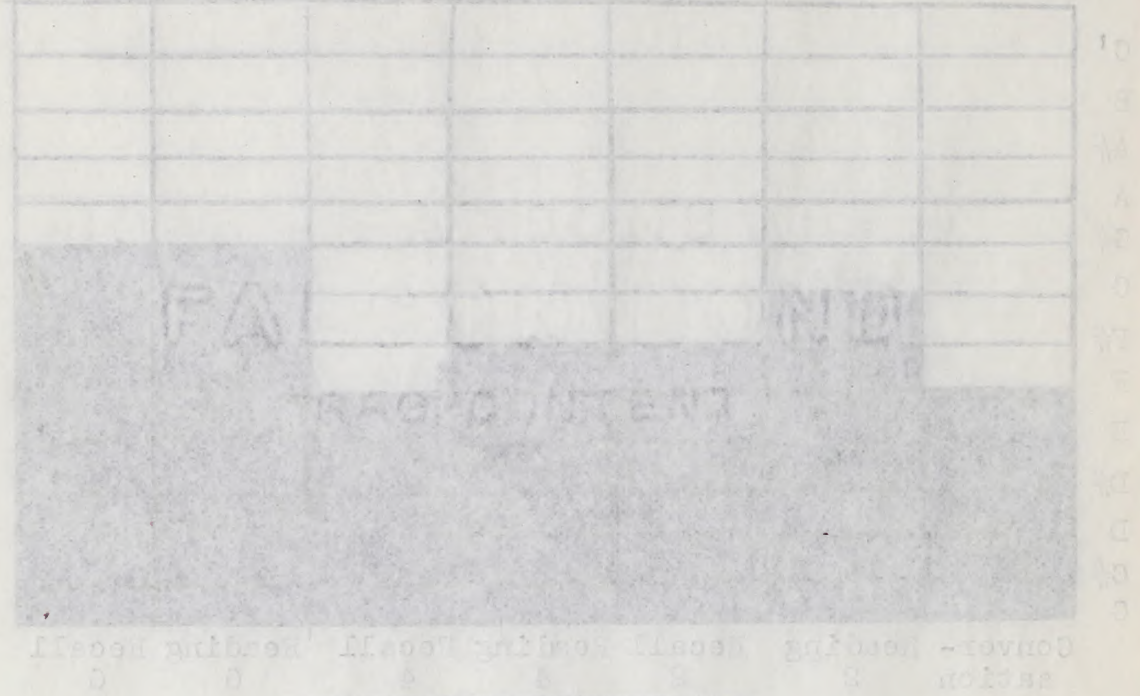


Figure VI

Figure VI shows the results of the tests of the "Metropolitan Achievement Test" (profile) for the order of the paragraphs.

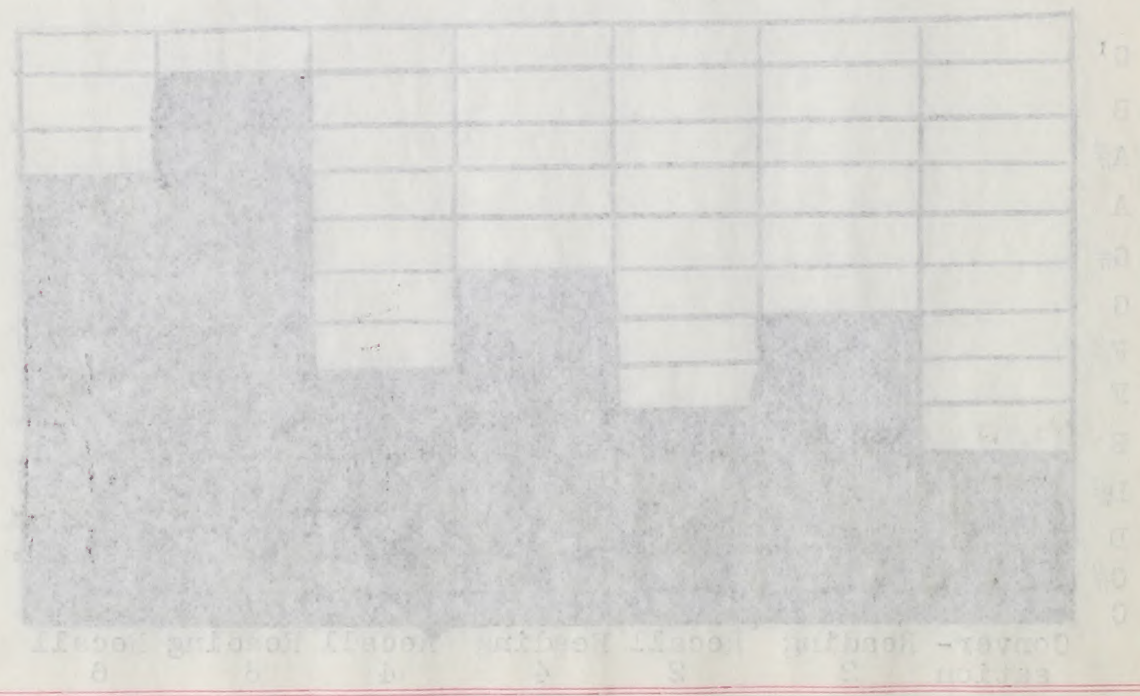
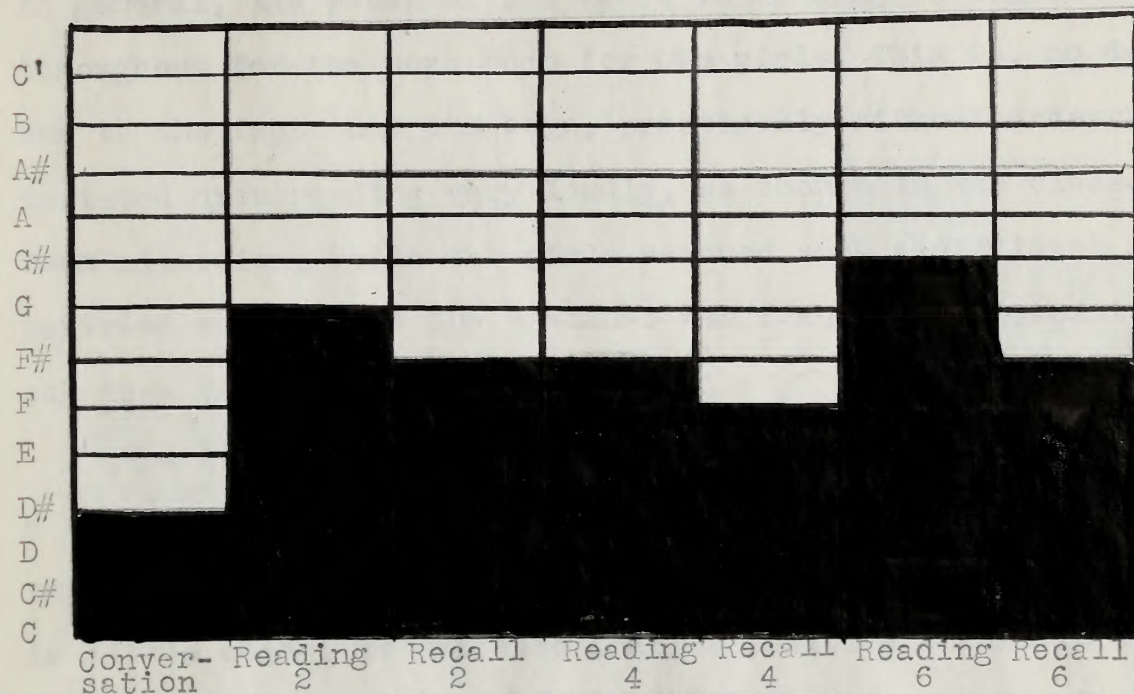




Figure VII

Pitch Profile of 13 Boys Reading Paragraphs # 2, 4, 6 of the "Durrell Analysis of Reading Difficulty" (profile irrespective of the order of the paragraphs)

Figure VIII

Pitch Profile of 16 Girls Reading Paragraphs #2, 4, 6 of the "Durrell Analysis of Reading Difficulty" (profile irrespective of the order of paragraphs)

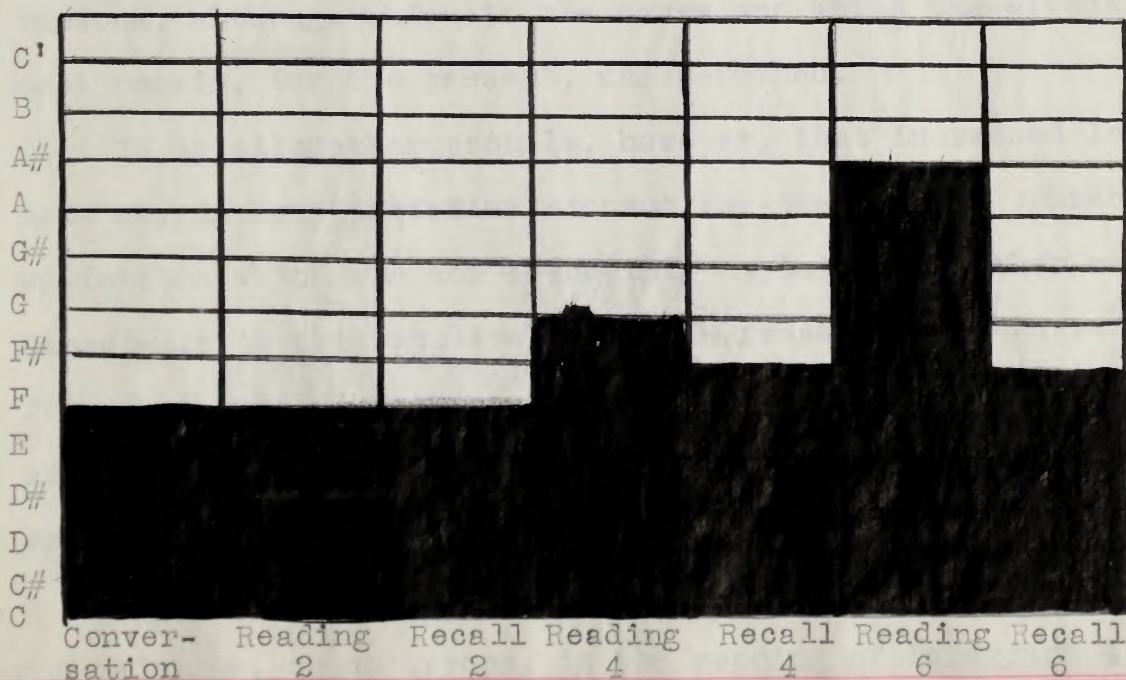


Figure VII  
 Plot Profile of 15 foot reading paragraphs 2, 4, 6 of the  
 "Bureau Analysis of Reading Difficulty" (profile perspective  
 of the order of paragraphs)

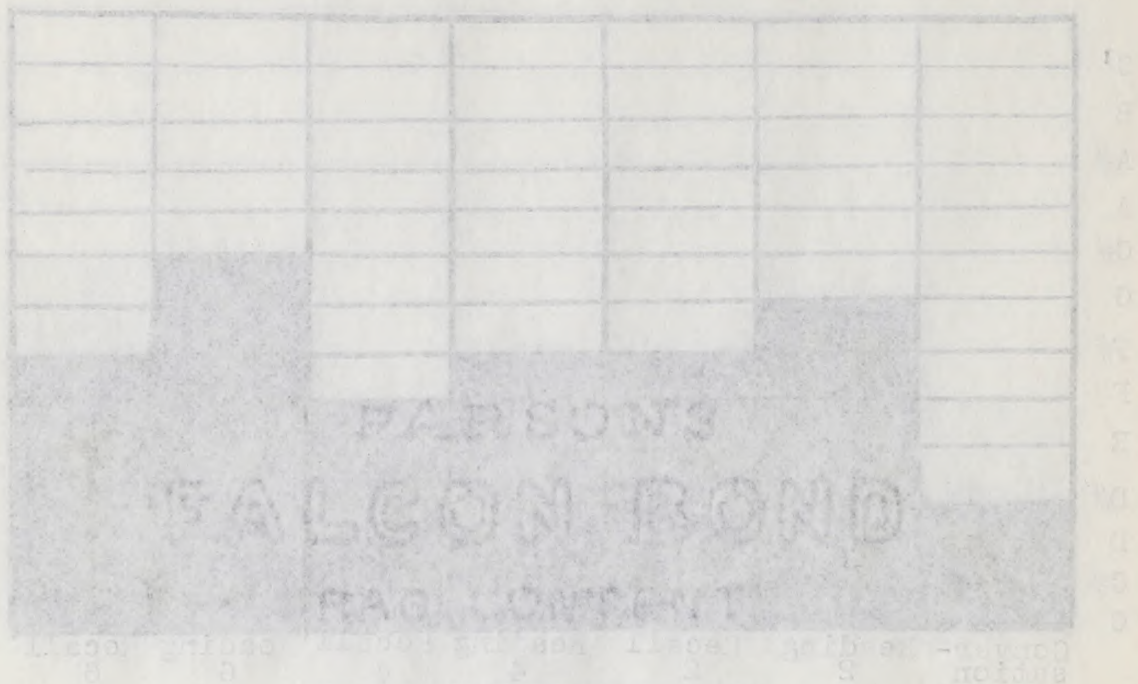
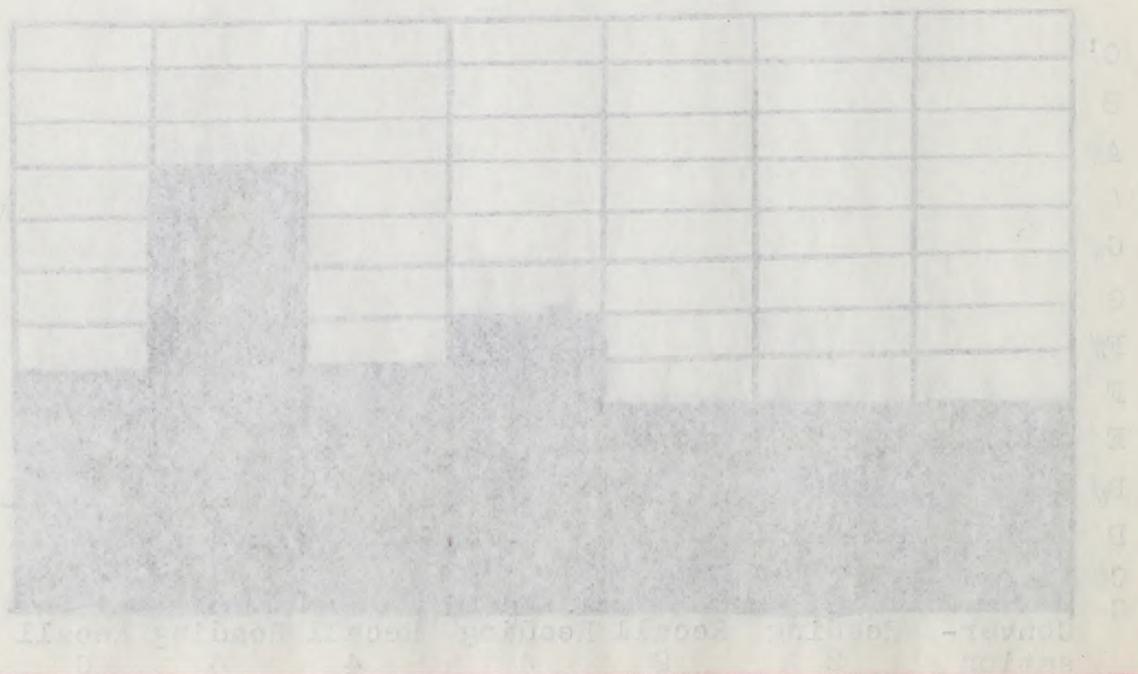


Figure VIII  
 Plot Profile of 15 foot reading paragraphs 2, 4, 6 of the  
 "Bureau Analysis of Reading Difficulty" (profile perspective  
 of the order of paragraphs)





This is to be expected, since great differences in pitch between boys and girls voices are not readily apparent until pūbescence. In general, the pitch of the voice in reading is higher throughout for the boys than for the girls. This is, no doubt, due to the fact that the boys, practically without exception, insisted upon reading very loudly, as though in the class-room situation, while the girls assumed such a diffident and retiring manner that the examiner was frequently forced to ask them to speak more loudly.

The effect of loudness on the pitch of the voice, and as a contributing cause of many of many of the unexplained pitch variations has not here been discussed, largely because there is little objective evidence that is positive enough to be generally applicable. Horton, as mentioned in Chapter I, found that when an actor shifted from conversational to audience speech, heightened pitch and increased loudness were simultaneous, although which is the cause and which the effect must remain, for the present, undetermined.

It is altogether probale, however, that increased loudness may in many instances account for the unusual pitch variations which are not adequately explained by other causes. Especially is this applicable to the present data, where a four semi-tone difference between the conversational level and simple reading level of the boys and the girls is explained by no other factors.

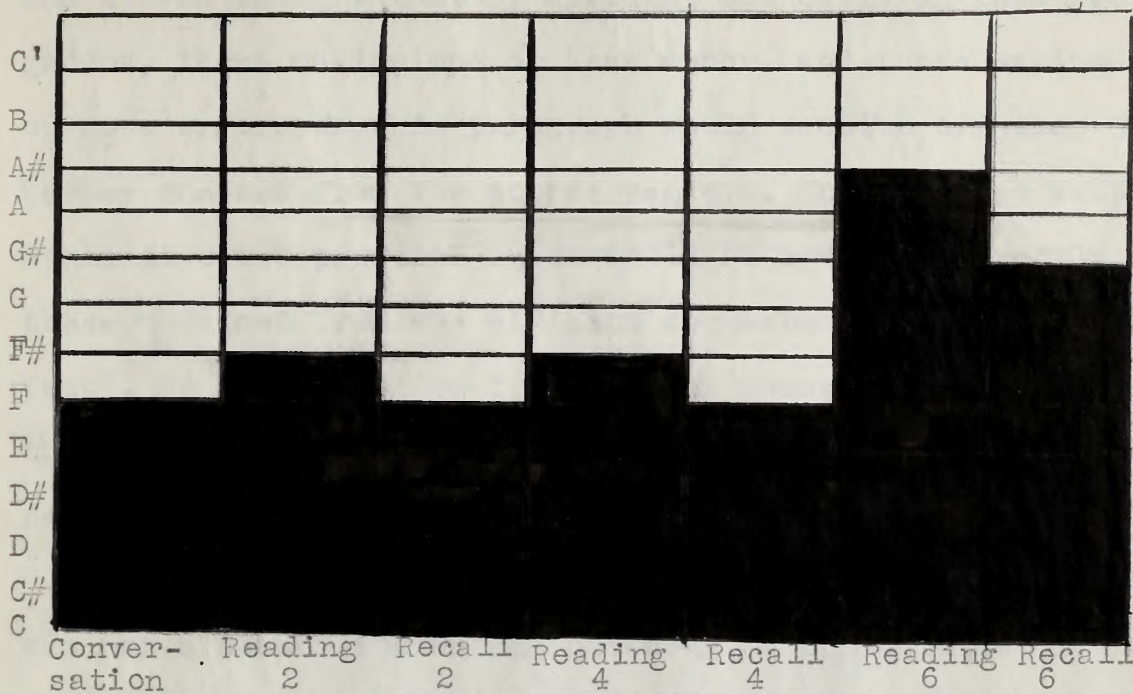
Figures IX and X present the profiles for those pupils who made one, or no errors, in the reading of Paragraph 4 and

This is to be expected, since great differences in pitch between boys and girls voices are not readily apparent until adolescence. In general, the pitch of the voice is tending to higher frequency for the boys than for the girls. This is, no doubt, due to the fact that the boys, practically without exception, initiated their speaking very loudly, as though in the class-room situation. While the girls seemed to be of different and varying manner, the speaker was frequently forced to speak in a more friendly manner. The effect of frequency on the pitch of the voice, and as a consequence of many of the variations of pitch, has not been discussed. It is little objective evidence that is positive enough to be generally applicable. However, as mentioned in Chapter I, found that when an actor shifted from a conversational to audience speech, his pitch fell and increased frequency was almost always, although when in the class and when the effect was most, for the reason, understood. It is altogether possible, however, that increased frequency may in many instances account for the normal pitch variations which are not adequately explained by other causes. Especially is this applicable to the present data, where a four-semitone difference between the conversational level and single reading level of the boys and girls is explained by no other factors. Figures IX and X present the profiles for these groups who made one, or no error, in the reading of Paragraph 4 and



Figure IX

Pitch Profiles of 15 Children Who Made No Errors, Or One Error  
in Reading Paragraph # 4 of the "Durrell Analysis of Reading  
Difficulty"

Figure X

Pitch Profiles of 11 Children Who Made Three or More Errors  
in Reading Paragraph #4 of the "Durrell Analysis of Reading  
Difficulty"

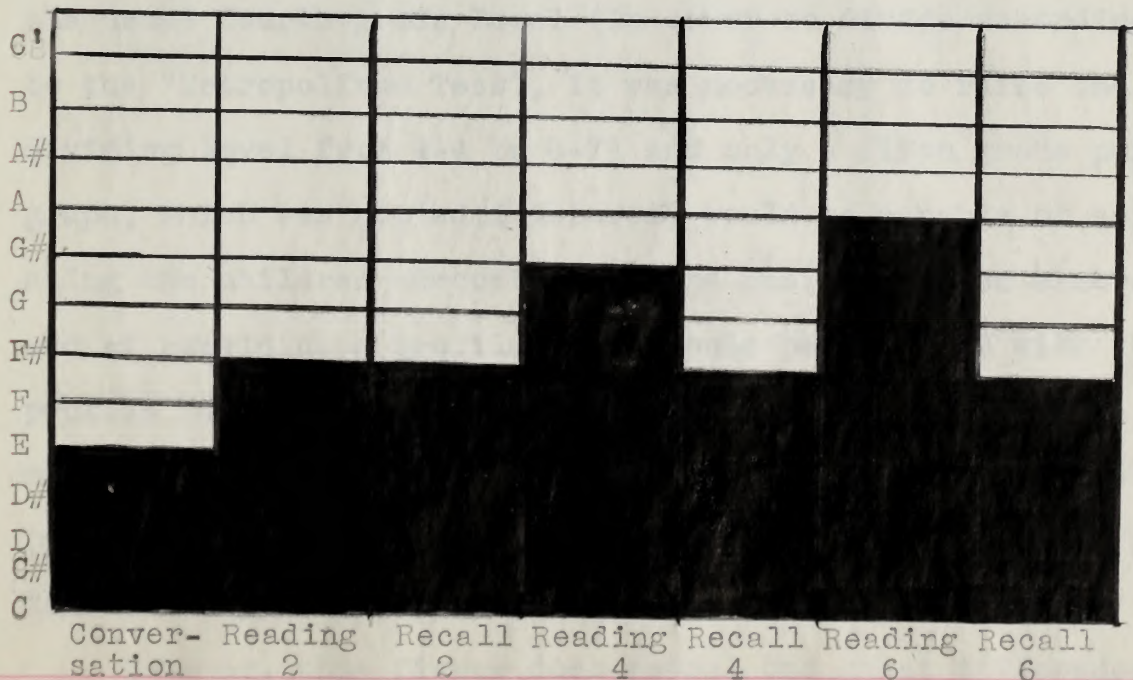


Figure 1A

Pitch profiles of 10 children who were 30 months, 32 months, or 34 months in hearing age at the time of the "Tuneless" analysis of hearing.

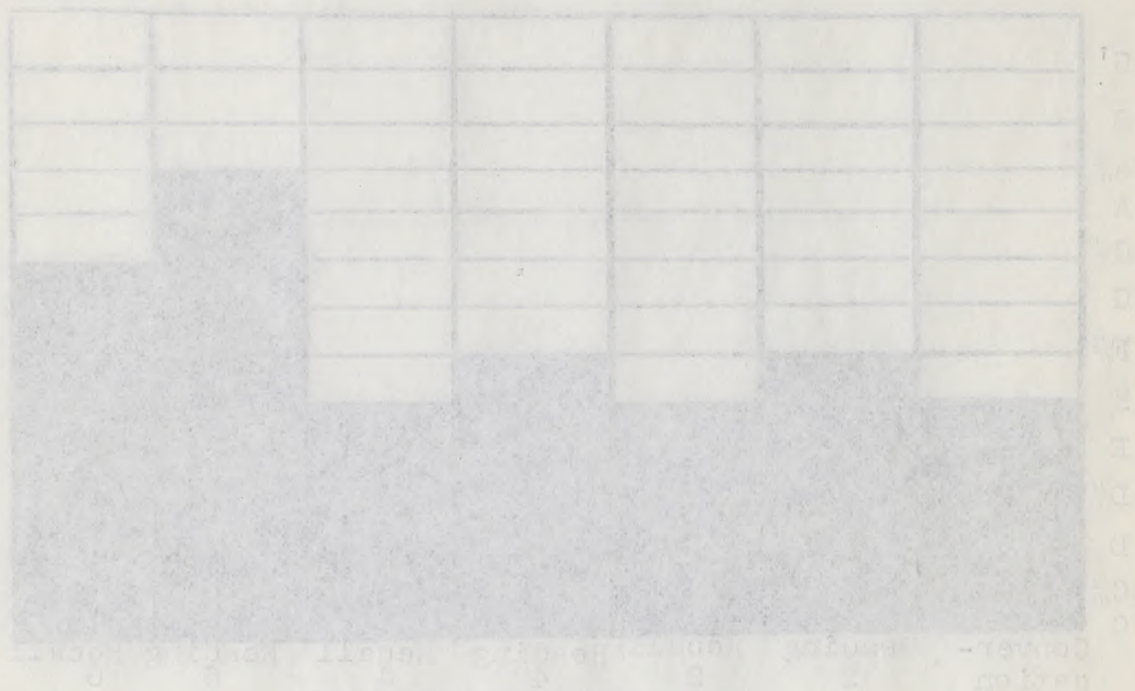
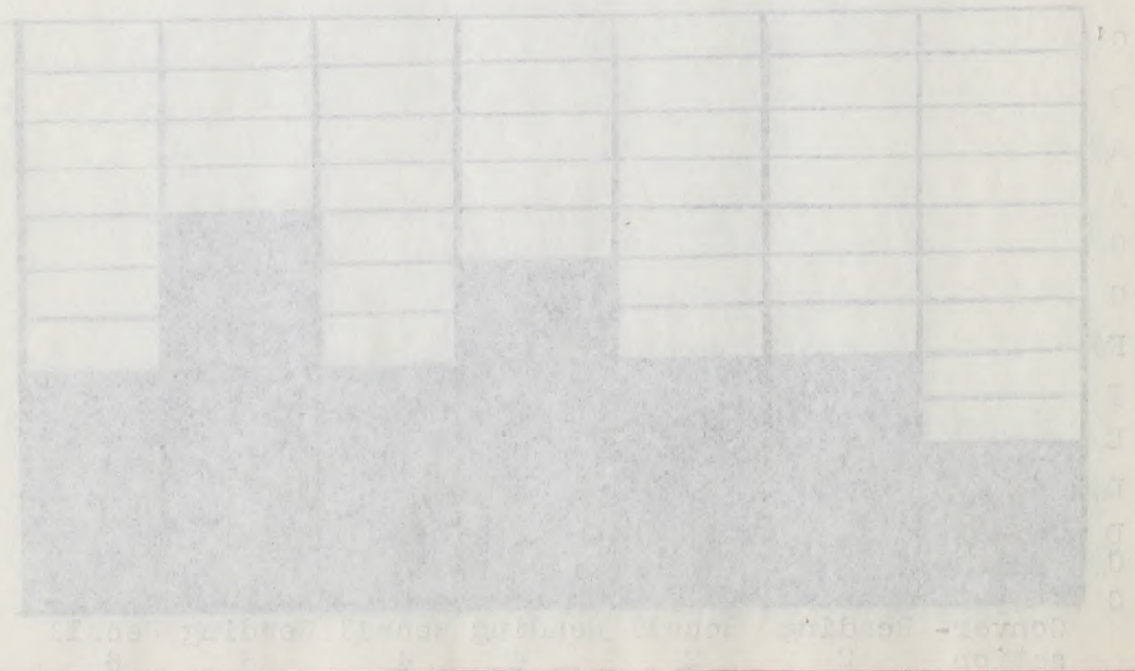


Figure 1B

Pitch profiles of 10 children who were 30 months, 32 months, or 34 months in hearing age at the time of the "Tuneless" analysis of hearing.





the profiles of those pupils making three or more such errors. The median number of errors for Paragraph 4 was two per child, and it was thought that by dividing the children into two groups, those making one or less error, and those making three or more errors on this paragraph would section off the better readers from the poorer readers. This, it was felt, would give two profiles which could be compared directly with those obtained from the division suggested by the "Metropolitan Test". An inspection of the profiles shows that this is not the case, for, in this illustration, our "poorer" readers are not strikingly different from the "better".

This is so largely because three errors on the paragraph was not a sensitive enough criteria. A child fails on this paragraph when he scores seven errors. Thus, since our division was arbitrary, we have not truly segregated the groups according to ability. In addition, the class is above the usual fourth grade level (in order to divide according to the "Metropolitan Test", it was necessary to raise the dividing level from 4-4 to 4-7) and only a fifth grade paragraph, which was not administered, would be capable of separating the children adequately on the basis of seven errors, and of providing a profile which could be compared with the profile for the "Metropolitan Test". Secondly, there is a much larger number of children in Figure IX than in X, hence, by force of numbers, the probability of obtaining higher pitch levels for this group is greater.

However, this figure does reveal one great difference

the analysis of these pupils making three or more such errors. The median number of errors for Paragraph 4 was two per child, and it was thought that providing the children with two groups, those making one or less error, and those making three or more errors on this paragraph would result in the better results from the poorer readers. This, it was felt, would give two profiles which could be compared directly with those obtained from the division suggested by the "ethological test". In the case of the profiles shown that this is not the case, for, in this illustration, the "poor" readers are not uniformly different from the "better".

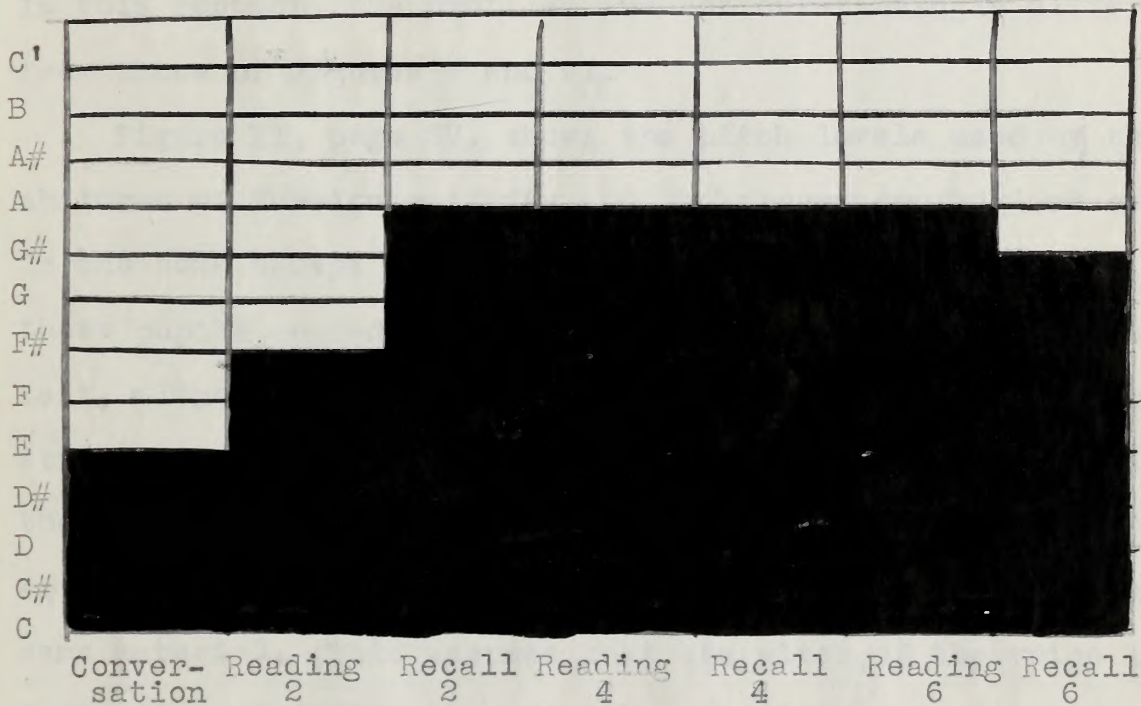
This is as might be expected. When errors on the paragraph are not a sensitive enough indicator, a child falls on this paragraph when he makes several errors. Thus, since our division was arbitrary, we have not truly segregated the groups according to ability. In addition, the class is above the usual fourth grade level (in order to divide according to the "ethological test", it was necessary to raise the dividing level from 4-4 to 4-5) and only a little grade range, which was not substantiated, would be capable of answering the division suggested on the basis of seven errors, and of providing a profile which could be compared with the profile for the "ethological test". However, there is a wide range of ability in children in Figure IX and in X, hence, by forcing uniformity, the probability of obtaining higher level for this group is greater.

However, this group does reveal one point of difference



Figure XI

Showing The Pitch Profile of Three Fourth Grade Children  
of Foreign Nativity and Background







between the groups, and that is in the matter of pitch for the easier reading and recall. The pitch of the "better" readers rises and falls one semi-tone rather regularly, following in pattern the averaged profiles for the entire group, (Figure I) while throughout the selections for the "poorer" readers, the pitch increases regularly with the difficulty of the material. In this respect, the profiles are not outstandingly different from those of Figures V and VI.

Figure XI, page 57, shows the pitch levels used by three children of foreign nativity and background (no English spoken in the home except by children of school age). Each of these pupils scored in the lowest profile of the achievement test, although they appear bright enough socially. The most striking indication from this figure is that which signifies that the recall of the subject matter for these children is equally as difficult as, or harder than, the reading of the same material. (This assumes that the pitch of the voice is indicative of difficulty with the material.) The reading and recall for these children was largely in a word-by-word manner, a halting for ideas in the recall, a stumbling, strained manner in the reading. During the reading of Paragraph 4, the voice had assumed a steady, monotonous pitch, and there remained until the recall of Paragraph 6, where a semi-tone drop in pitch occurred.

The last table (Table IV) indicates the average, lowest, and highest pitches, as well as the range, used by these

between the groups, and that is indicated by the fact that the "better" readers read faster and more accurately. The group of the "better" readers read faster and more accurately than the group of the "poorer" readers, following in pattern the average position for the entire group. (Figure 1) While throughout the collection for the "poorer" readers, the pitch increases regularly with the difficulty of the material. In this respect, the profiles are not substantially different from those of Figures V and VI.

Figure XI, page 67, shows the pitch levels used by these children of foreign nativity and background in English spoken in the home except by children of school age. Each of these profiles shows in the lower profile of the achievement test, although they represent different groups. The most striking indication from this figure is that a low pitch level is used for the reading of the English material for these children is equally as difficult as, or harder than, the reading of the same material. (This suggests that the pitch of the voice is indicative of difficulty with the material.) The reading and recall for these children was largely in a word-by-word manner, a habit for them in the recall, a stumbling, strained manner in the reading, lacking the reading of Paragraph 4, the voice had reached a steady monotonous pitch, and there remained until the recall of Paragraph 4, where a word-by-word pitch occurred.

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Table IV

Showing the Lowest, Highest and Average Pitches Employed by 29 Fourth Grade Children in Conversation and in the Oral Reading of Three Paragraphs of the "Durrell Analysis of Reading Difficulty"

	Lowest	Average	Highest	Range (in semi-tones)
Conversation	G#.	E	F'	21
Reading 2	A.	F#	E'	19
Recall 2	G#.	E	C'	16
Reading 4	F.	F#	D#'	22
Recall 4	A.	E	D'	17
Reading 6	B.	A	G'	20
Recall 6	G#.	G	D'	16

Table IV

Showing the Lowest, Highest and Average Fittness Employed  
by 22 Fourth Grade Children in Conversation and in the  
oral Reading of three paragraphs of the "Laurie Analysis"  
of Reading Difficulty

Lowest Average Highest Range (in semi- tones)				
Conversation	64.	7	74	21
Reading 2	A.	14	27	19
Recall 2	67.	7	74	18
Reading 4	7.	14	14	22
Recall 4	A.	7	14	14
Reading 6	B.	A	67	22
Recall 6	64.	6	74	18



children under discussion. This table does not present the frequency of the pitches, although the pitch here cited was reported by all observers. (One exception to this is in Reading 4, where two observers report F., and the third reports A#. .) This table is hardly significant, but it included to show that the range of the childrens voices varied from the lower limits of the average alto voice to within four semi-tones of the upper limits of the average soprano voice, a large range for such a limited investigation.

A summarization of the data included in this section is presented in Chapter IV, but a few observations on the analysis of data may here be presented.

In the pooling of data to obtain average profiles, we lose sight entirely of the individual child. This should not be so, since pitch is a completely individual function, and by nature not meant for generalizations and averagings. However, were one to discuss, and present illustrations for individual children only, the difficulties of explanation and interpretation would be completely overwhelming, even for a group this size. Averaging the data was the only feasible way in this study to present indications and trends.

Explanations of pitch phenomena must take into consideration such a multitude of variables, educational, psychological, social and emotional, as well as the chance factor, that the explanations herein offered, even for the average groups, must be viewed as possible interpretations, not ultimate solutions.

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Explanations of pitch phenomena must take into consideration such a multitude of variables, educational, psychological, social and emotional, as well as the chance factor, that the explanations herein offered, even for the average group, must be viewed as possible interpretations, not definite solutions.



There can be no single cause of pitch variations, but several causes may, in the light of supporting evidence, indicate possible factors whose combined efforts produce a single effect. To make strong conclusions from such data, obtained in such a relatively short interval, is completely rash.

In addition, no average group contains the same number of children in the averagings. This is unfortunate, since direct comparison between groups is made impossible, but little can be done now that the data has all been obtained.

In the selection of typical passages it will be noticed that the samples often contain a wide variation in pitch range, for example, the reading of Paragraph 6 by Child 1B shows a fluctuation from C to C' and back to G#. . Questions might well be raised concerning the selection of such a passage as representative. However, if wide ranges were employed throughout the passage, the sample selected also contained a wide range, in addition to the centering of the pitch about a certain level which is the dominant pitch for the obtained passage.

This is here mentioned in order that the significance of a four or five semi-tone increase from one level to another may be better understood. "Significance" and "significant" were terms often loosely employed in this Chapter, especially in reference to an increase similar to the one mentioned above. How significant these changes are, in the statistical sense of the word, is undetermined. We know from Cowan's

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range. For example, the reading of Paragraph 2 of Child 15  
shows a fluctuation from 2 to 5 and back to 2. A passage  
might well be taken containing the selection of such a  
passage as representative. However, if the ranges were  
removed throughout the passage, the range selected also  
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above. Now significant means changes etc., in the statistical  
sense of the word, is understood. We now find Towns'



study that the average pitch level of a given individual in different dramatic passages having the same pitch level can vary as much as five semi-tones, and still be an accurate interpretation. Strictly speaking, this study should have reserved the use of "significant" to designate only those pitch increases above this five semi-tone variation, but this procedure seems a little unnecessary in that these subjects are children, untutored in the dramatic techniques, reading three paragraphs of factual material in a more or less natural situation. It may then be assumed that if different samples of the child's reading - each sample equally as representative of the range employed in the entire selection - vary their average pitch by four or five semi-tones, that increase is significant.

Exactly what this significant difference in pitch levels betokens has usually been understood to be either increased difficulty of the reading, or of a tension arising from within the situation that is not a result of innate difficulty of the material. With an understanding of the procedure used in the selection of samples, the use of "significant" to describe these varying average pitches will not be questioned too severely.

A further liberty has been taken in assuming that high pitch is indicative of tension, and that tension is indicative of some reading difficulty in the situation. We know definitely nothing of the sort, and the only basis for such an assumption is that other writers have also assumed the same thing.

study that the average pitch level of a given individual in different directions was not having the same pitch level as very an average five semi-tones, and will be an accurate interpretation. Strictly speaking, this study should have reserved the use of "stimulus" to designate only those pitch levels above the five semi-tone variation, but this procedure seems a little unnecessary in that these subjects are children, interested in the dramatic techniques, reading these paragraphs of factual material in a more or less natural situation. It may then be assumed that if different samples of the child's reading - each sample equally as representative of the range employed in the entire selection - very their average pitch by four or five semi-tones, that increase is significant.

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Whether this is true or not, as must be proven by research, it has, in this study, been understood as true, and many of the conclusions have for a cornerstone only this slender opinion,

With the above criteria of significance in mind, we may proceed to the "Summary and Conclusions", Chapter IV.

#### SUMMARY AND CONCLUSIONS

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## SUMMARY AND CONCLUSIONS

STANDARD AND PRACTICE



## Summary and Conclusions

### Summary

To obtain the data for this investigation, twenty-nine fourth grade children read three paragraphs from the "Durrell Analysis of Reading Difficulty", one paragraph designed to test second grade reading, one for fourth, and one for sixth. In addition to the checking of errors for the reading of each paragraph, the conversation of two of the children alone in the room, and selected sentences from the reading and recall of the material was permanently recorded on records. Thus was obtained samples of the conversation and the reading and recall of three paragraphs for each child in the investigation.

Three judges scoring high on the "Seashore Test of Musical Talent" were asked to judge the pitch of five running syllables of speech from each of these levels, for each child. This made a total of one thousand fifteen syllables analysed by the judges. To check on the reliability of these judgments, each judge re-evaluated ninety syllables of speech, from which correlation coefficients were obtained for the agreement between judges and judgments.

From these judgments thus evaluated, data was secured on the following: the average pitch levels of the twenty-nine subjects for conversation and for the each level of the reading and recall; the pitch levels employed by boys and girls; the pitch levels utilized by better and poorer readers, and the readers from foreign language backgrounds.

## Summary and Conclusions

### Summary

To obtain the data for this investigation, twenty-nine foreign grade children read three paragraphs from the "Twelve" Analysis of Reading Difficulty", one paragraph assigned to each second grade reading, one for fourth, and one for sixth. In addition to the checking of errors for the reading of each paragraph, the conversation of two of the children alone in the room, and selected sentences from the reading and recall of the material was systematically recorded on records. These were obtained samples of the conversation and the reading and recall of these paragraphs for each child in the investigation. Three judges selected eight of the "Twelve" Test of Reading Ability" were asked to judge the piece of five running syllables to appear from each of these levels, for each child. This made a total of one hundred fifteen syllables analyzed by the judges. To check on the reliability of these judgments, each judge re-evaluated thirty syllables at a later date, from which correlation coefficients were obtained for the agreement between judges and judgments. The data judgments were evaluated, and were assumed on the following: the average pitch levels of the twenty-nine subjects in conversation and for the each level of the reading and recall; the pitch levels employed by boys and girls; the pitch levels utilized by better and poorer readers; and the readers from foreign language backgrounds.



These data, in general, agree upon a few main points, namely: that heightened pitch accompanies difficult reading, or the initial reading above the child's fluent reading level. Once a pitch was raised abnormally for the reading material, the indications are that it there remains for some times, until the child has either been assured that less difficult reading is to follow, or has once regained his usual pitch level through recall of the material.

Little difference in the pitch profile of boys as contrasted with the pitch profiles of the girls is evident, except that the loudness of the boys speaking voices caused the pitch to remain a little higher throughout the reading. The range of pitch is no greater for the boys than for the girls, if we count the number of semi-tones from the conversation to the highest pitch level.

A marked difference in the pitch levels employed by better and poorer readers is apparent, the better readers employing much lower pitches throughout all reading, although slightly higher pitches in the conversation.

Bilingual children are considerably handicapped in their reading, as much by their inability to either understand the material or to recall the ideas fluently, as by the mechanics of the reading itself.

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correlation, in consideration of the many difficulties attendant upon obtaining such a correlation, is usually present.

### Conclusions

In view of the limited number of subjects used in this investigation, and of the low correlations obtained on the three judges, no sweeping conclusions or great generalizations can be made from this data. Thus, many qualifications and limitations of the conclusions to but conclusions for this study only, must be expressed. This is here mentioned, and when necessary, is stated again in the following paragraphs.

The conclusions for this study are:

(1) Difficult reading is reflected by heightened pitch of the voice in oral reading, though heightened pitch is not always indicative of difficult reading material. A constant raising of the pitch for each increasingly difficult selection was present in each child in the investigation. Although there are, conceivably, many factors which would account for the raising of the pitch in some instances, these other factors as sole explanations for all pitch increases are completely inadequate. The one influence that was constant throughout, and thus may account for the heightening of the pitch, is that of the difficulty of the material.

(2) Most oral reading utilizes a pitch level above that of conversation. The few exceptions to this are those instances in which the recorded conversation was completely spontaneous,

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and as a result, loud. The effect of loudness on pitch has been summarily discusses, and in some instances this may account for a higher pitch in conversation than in reading, although it is equally probable that many children, and the majority of adults speak no louder in their reading than in their conversation, the pitch in both instances being entirely relative to the situation and not to habit.

(3) The pitch of the voice remains high even when the original stimulus of reading difficulty and/or tension has been removed. This study observed a strong trend for the pitch of these childrens' voices to remain almost as high for the reading of a simple paragraph (after reading difficult material) as for the reading of the difficult material itself. Although no conclusions as to habit patterns can be made, we find that the continuance of a situation in which the pitch is raised may result in a continuance of the pitch when the situation has been removed.

(4) The pitch of the speaking voice may be evaluated by judges if but an average, and not an exacting, picture, is desired. The reliability of pitch analysis by the subjective method of matching the pitch to a piano is not, in this study, as high as the literature in the field reports. This indicates in itself, that the judgment method requires such a nice selection of judges, records, acoustical properties of the room, and other such physical conditions, that it is little easier, and far less accurate than analysis by mechanical

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(3) The pitch of the voice remains high even when the original stimulus of reading difficulty and/or tension has been removed. This study observed a strong trend for the pitch of these children's voices to remain slightly high for the reading of a single paragraph (after reading difficult material) as for the reading of the difficult material itself. Although no conclusion as to what pattern can be made, we find that the continuance of a situation in which the pitch is raised may result in a continuance of the pitch when the situation has been removed.

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methods. When, for financial reasons, this method is necessary, extreme caution in the analysis must be evident.

In summary, high pitch of the voice in the reading situation may be caused by (1) difficulty of the material, (2) tenseness of the situation, and (3) habit, induced by the continued oral reading of difficult material.

#### LIMITATIONS OF THE PRESENT INVESTIGATION

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LIMITATIONS OF THE PRESENT STUDY



### Limitations of the Present Investigation

Many limitations of this investigation have been mentioned throughout the study, but may here be recapitulated for further emphasis. The principal flaw in this investigation is in the limited number of subjects used. The conclusion obtained from but twenty-nine children are of use only in the nature of pointing out trends or indications, for generalizations on all reading they are highly gratuitous.

In addition, the data - although pains were taken to insure its reliability - may, in many instances, be completely biased. This does not mean deliberate bias by the author, but the inevitable bias that occurs in the selection of representative passages from but very small original samples. Also, the samples were obtained from a testing situation, and must be viewed as such. Any reading that a child performs before a critical adult must, in the last analysis, resolve into a testing situation, this despite any amount of rapport. These data must be likened to the data secured from an individual intelligence test - that obtained from a child in a testing situation and to be compared with those obtained from other children under identical physical circumstances. Had the recording device been successfully concealed in the classroom, and had no adults except the teacher been present, the records might be considered more authentic.

A further limitation is that these children are reading but one type of material - narrative, strongly factual.

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A further limitation is that these children are reading

but one type of material - narrative, strongly fictional.



Dramatic passages, even poetic passages, might reveal a quite dissimilar pitch profile for the group, with individual differences, and not the profiles, assuming the chief role in the report.

The obtained records themselves, are far from flawless. Electrical interference, whose source could not be traced, occasionally blurred many passages, this imposing a greater handicap on the judges. Then too, the acoustical properties of the testing room and the room used for analysis were not taken into consideration. This resulted in a "hollow" background in the records, and an echo effect when played to the judges.

In general, the investigation reveals many limitations, no one of which completely invalidates the data, but the several combinations of which may result in a report whose flaws must be considered as carefully as the data it presents.

Various passengers, even female passengers, might reveal a motive

disaster given profile for the group, with individual

attitudes, and not the profile, regarding the entire role in

the report.

The obtained records themselves, are far from flawless.

Statistical information, where sources could not be traced,

occasionally placed many passengers, this imposing a greater

handicap on the judges. When too, the secondary properties

of the testing tool and the room used for analysis were not

taken into consideration, this resulted in a "hollow" result.

ground in the records, and an extra effort was placed to the

judges.

In general, the investigation reveals many limitations,

no one of which completely invalidated the data, and the

several combinations of which may result in a report whose

flaws must be considered as carefully as the data is presented.



## Indications for Further Research

Before a complete understanding of the pitch factor in reading can be obtained, there remains much research to be first accomplished.

Such an undertaking would first call for the penetrating analysis of the pitch actually used in American speech. With this as a base, the relationship between pitch and meaning would be investigated. This is a fascinating problem, and a highly significant one for the speech field. Such an investigation would require the elaborate laboratory devices used to measure the changes in bodily tissue and energy, in addition to the recording of voice speaking

## INDICATIONS FOR FURTHER RESEARCH

different types of material, and the analysis of these data by methods such as spectroscopy. The study of pitch can best be obtained in a situation relatively free from the laboratory and laboratory limitations. It is a part of the problem. It seems important to be used in the selection of subjects, and it is not necessary to study the pitch phenomena that in our present state of knowledge require to be studied.

Studies on the variability of speech pitch must be carried out in a laboratory for which the conditions of performance are day to day, or perhaps from hour to hour. This study should be carried out with the pitch of the voice as a factor - and yet not within the normal pitch range.

With the above as background, the present study should

INDICATIONS FOR FURTHER RESEARCH



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Before a complete understanding of the pitch factor in reading can be obtained, there remains much research to be first accomplished.

Such an understanding would first call for the penetrating analysis of the pitches commonly used in American speech. With this as a base, the relationship between pitch and muscular tension must be thoroughly investigated. This is a fascinating problem, and a highly significant one for the speech field. Such an investigation would require the elaborate laboratory devices used to measure the changes in bodily tones and energy, in addition to the recording of voices speaking different types of material, and the analysis of these data by phonophotographic instruments. How these measurements can best be obtained in a situation relatively free from the laboratory and laboratory impedimenta is no small part of the problem. If keen judgment be used in the selection of subjects, this study should explain many of the pitch phenomena that in our present state of knowledge remains open to but speculation.

Studies on the variability of average pitch must be performed to determine how much the conversational tone varies from day to day, or perhaps from hour to hour. This study should further discuss within what limits the pitch of the voice may vary - while reading the same material - and yet remain within the normal pitch range.

With the above as background, the present study should

## Indications for Further Research

Before a complete understanding of the pitch factor in reading can be obtained, there remains much research to be first accomplished.

Such an understanding would first call for the penetrating analysis of the pitches commonly used in American speech. With this as a base, the relationship between pitch and muscular tension must be thoroughly investigated. This is a fascinating problem, and a highly significant one for the speech field. Such an investigation would require the elaborate laboratory devices used to measure the changes in bodily forces and energy, in addition to the recording of voices speaking different types of material, and the analysis of these data by phonographic instruments. Now these measurements can best be obtained in a situation relatively free from the laboratory and laboratory impediments. In the real part of the problem, it seems judgment be used in the selection of subjects. This study would explain many of the pitch phenomena that in our present state of knowledge remains open to our speculation. Studies on the variability of average pitch must be performed to determine how much the conversational tone varies from day to day, or perhaps from hour to hour. This study should further discuss within what limits the pitch of the voice may vary - while reading the same material - and yet remain within the normal pitch range. With the above as background, the present study should



be duplicated, for the explanations of many of the pitch variations observed in the childrens reading may then be explained with authority, and hence the educational implications of heightened pitch may become apparent.

be quite low, for the explanation of many of the other  
 variations observed in the edition reading may then be  
 explained with authority, and hence the editorial judgment  
 of the editor of the text becomes apparent.



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TABLE 2

Showing the Sex, Age, and the Score on the "Metropolitan Achievement Test" of the Army Used in this Investigation.

Serial #	Sex	Age	Score
14	F	9-4	4-0
15	M	9-9	6-3
24	F	9-11	5-3
26	F	9-10	4-3
41	F	10-1	5-0
42	M	9-10	4-7
61	F	9-8	4-6
70	M	9-10	5-2
71	F	10-8	4-0
72	M	10-3	5-0
73	F	11-2	4-7
74	M	9-9	4-5
84	F	9-9	4-4
88	F	9-8	4-3
91	M	10-0	3-7
99	F	9-10	5-0
104	M	10-2	3-0
105	M	10-11	4-0
114	F	10-1	2-0
115	F	9-11	4-0
121	M	9-9	5-3
122	F	9-10	4-7
131	F	9-8	4-0
132	F	10-8	4-0
144	F	11-0	4-7
151	M	10-0	5-2
161	F	10-1	3-0
170	F	9-3	3-0
Totals for			100
Average			4-7

XIV



TABLE A

Showing the Sex, Age, and the Score on the "Metropolitan Achievement Test" of the Group Used in this Investigation.

Child #	Sex	Age	Score
1A	F	9-0	4-9
1B	M	9-9	5-1
2A	M	8-11	5-3
3A	F	9-10	4-8
4A	F	10-1	5-0
4B	F	9-10	4-7
5A	M	9-9	4-6
5B	M	9-10	5-2
6A	F	10-5	4-8
6B	M	10-3	5-0
7A	M	9-2	4-7
7B	M	8-9	5-6
8A	F	9-9	4-4
8B	F	9-8	4-1
9A	M	10-0	3-7
9B	M	9-10	3-0
10A	M	10-2	3-8
10B	M	10-11	4-6
11A	F	10-2	3-8
11B	F	9-11	4-8
12A	M	9-9	5-3
12B	M	9-10	4-9
13A	F	9-2	4-6
13B	F	10-3	5-2
14A	F	11-5	4-0
15A	F	9-5	5-4
15B	F	10-11	3-8
15C	F	9-3	4-0
Totals or Averages	29	13M 16F	9-10 4-7

# TABLE A

Showing the Test, Age, and Sex of the "Neurological Achievement Test" of the group used in this investigation.

Group	Age	Sex	Order
1-2	9-0	M	1A
2-1	9-0	M	1B
3-2	9-11	M	2A
4-3	9-10	M	2B
5-0	10-1	M	3A
6-7	9-10	M	3B
7-8	9-8	M	4A
8-9	9-10	M	4B
9-6	10-5	M	5A
10-0	10-5	M	5B
11-7	9-8	M	6A
12-8	9-9	M	6B
13-1	9-10	M	7A
14-2	9-8	M	7B
15-3	10-0	M	8A
16-4	9-10	M	8B
17-5	10-3	M	9A
18-6	10-11	M	9B
19-7	10-1	M	10A
20-8	10-1	M	10B
21-9	10-1	M	11A
22-0	10-1	M	11B
23-1	10-1	M	12A
24-2	10-1	M	12B
25-3	10-1	M	13A
26-4	10-1	M	13B
27-5	10-1	M	14A
28-6	10-1	M	14B
29-7	10-1	M	15A
30-8	10-1	M	15B
31-9	10-1	M	16A
32-0	10-1	M	16B
33-1	10-1	M	17A
34-2	10-1	M	17B
35-3	10-1	M	18A
36-4	10-1	M	18B
37-5	10-1	M	19A
38-6	10-1	M	19B
39-7	10-1	M	20A
40-8	10-1	M	20B
41-9	10-1	M	21A
42-0	10-1	M	21B
43-1	10-1	M	22A
44-2	10-1	M	22B
45-3	10-1	M	23A
46-4	10-1	M	23B
47-5	10-1	M	24A
48-6	10-1	M	24B
49-7	10-1	M	25A
50-8	10-1	M	25B
51-9	10-1	M	26A
52-0	10-1	M	26B
53-1	10-1	M	27A
54-2	10-1	M	27B
55-3	10-1	M	28A
56-4	10-1	M	28B
57-5	10-1	M	29A
58-6	10-1	M	29B
59-7	10-1	M	30A
60-8	10-1	M	30B
61-9	10-1	M	31A
62-0	10-1	M	31B
63-1	10-1	M	32A
64-2	10-1	M	32B
65-3	10-1	M	33A
66-4	10-1	M	33B
67-5	10-1	M	34A
68-6	10-1	M	34B
69-7	10-1	M	35A
70-8	10-1	M	35B
71-9	10-1	M	36A
72-0	10-1	M	36B
73-1	10-1	M	37A
74-2	10-1	M	37B
75-3	10-1	M	38A
76-4	10-1	M	38B
77-5	10-1	M	39A
78-6	10-1	M	39B
79-7	10-1	M	40A
80-8	10-1	M	40B
81-9	10-1	M	41A
82-0	10-1	M	41B
83-1	10-1	M	42A
84-2	10-1	M	42B
85-3	10-1	M	43A
86-4	10-1	M	43B
87-5	10-1	M	44A
88-6	10-1	M	44B
89-7	10-1	M	45A
90-8	10-1	M	45B
91-9	10-1	M	46A
92-0	10-1	M	46B
93-1	10-1	M	47A
94-2	10-1	M	47B
95-3	10-1	M	48A
96-4	10-1	M	48B
97-5	10-1	M	49A
98-6	10-1	M	49B
99-7	10-1	M	50A
100-8	10-1	M	50B
101-9	10-1	M	51A
102-0	10-1	M	51B
103-1	10-1	M	52A
104-2	10-1	M	52B
105-3	10-1	M	53A
106-4	10-1	M	53B
107-5	10-1	M	54A
108-6	10-1	M	54B
109-7	10-1	M	55A
110-8	10-1	M	55B
111-9	10-1	M	56A
112-0	10-1	M	56B
113-1	10-1	M	57A
114-2	10-1	M	57B
115-3	10-1	M	58A
116-4	10-1	M	58B
117-5	10-1	M	59A
118-6	10-1	M	59B
119-7	10-1	M	60A
120-8	10-1	M	60B
121-9	10-1	M	61A
122-0	10-1	M	61B
123-1	10-1	M	62A
124-2	10-1	M	62B
125-3	10-1	M	63A
126-4	10-1	M	63B
127-5	10-1	M	64A
128-6	10-1	M	64B
129-7	10-1	M	65A
130-8	10-1	M	65B
131-9	10-1	M	66A
132-0	10-1	M	66B
133-1	10-1	M	67A
134-2	10-1	M	67B
135-3	10-1	M	68A
136-4	10-1	M	68B
137-5	10-1	M	69A
138-6	10-1	M	69B
139-7	10-1	M	70A
140-8	10-1	M	70B
141-9	10-1	M	71A
142-0	10-1	M	71B
143-1	10-1	M	72A
144-2	10-1	M	72B
145-3	10-1	M	73A
146-4	10-1	M	73B
147-5	10-1	M	74A
148-6	10-1	M	74B
149-7	10-1	M	75A
150-8	10-1	M	75B
151-9	10-1	M	76A
152-0	10-1	M	76B
153-1	10-1	M	77A
154-2	10-1	M	77B
155-3	10-1	M	78A
156-4	10-1	M	78B
157-5	10-1	M	79A
158-6	10-1	M	79B
159-7	10-1	M	80A
160-8	10-1	M	80B
161-9	10-1	M	81A
162-0	10-1	M	81B
163-1	10-1	M	82A
164-2	10-1	M	82B
165-3	10-1	M	83A
166-4	10-1	M	83B
167-5	10-1	M	84A
168-6	10-1	M	84B
169-7	10-1	M	85A
170-8	10-1	M	85B
171-9	10-1	M	86A
172-0	10-1	M	86B
173-1	10-1	M	87A
174-2	10-1	M	87B
175-3	10-1	M	88A
176-4	10-1	M	88B
177-5	10-1	M	89A
178-6	10-1	M	89B
179-7	10-1	M	90A
180-8	10-1	M	90B
181-9	10-1	M	91A
182-0	10-1	M	91B
183-1	10-1	M	92A
184-2	10-1	M	92B
185-3	10-1	M	93A
186-4	10-1	M	93B
187-5	10-1	M	94A
188-6	10-1	M	94B
189-7	10-1	M	95A
190-8	10-1	M	95B
191-9	10-1	M	96A
192-0	10-1	M	96B
193-1	10-1	M	97A
194-2	10-1	M	97B
195-3	10-1	M	98A
196-4	10-1	M	98B
197-5	10-1	M	99A
198-6	10-1	M	99B
199-7	10-1	M	100A
200-8	10-1	M	100B
201-9	10-1	M	101A
202-0	10-1	M	101B
203-1	10-1	M	102A
204-2	10-1	M	102B
205-3	10-1	M	103A
206-4	10-1	M	103B
207-5	10-1	M	104A
208-6	10-1	M	104B
209-7	10-1	M	105A
210-8	10-1	M	105B
211-9	10-1	M	106A
212-0	10-1	M	106B
213-1	10-1	M	107A
214-2	10-1	M	107B
215-3	10-1	M	108A
216-4	10-1	M	108B
217-5	10-1	M	109A
218-6	10-1	M	109B
219-7	10-1	M	110A
220-8	10-1	M	110B
221-9	10-1	M	111A
222-0	10-1	M	111B
223-1	10-1	M	112A
224-2	10-1	M	112B
225-3	10-1	M	113A
226-4	10-1	M	113B
227-5	10-1	M	114A
228-6	10-1	M	114B
229-7	10-1	M	115A
230-8	10-1	M	115B
231-9	10-1	M	116A
232-0	10-1	M	116B
233-1	10-1	M	117A
234-2	10-1	M	117B
235-3	10-1	M	118A
236-4	10-1	M	118B
237-5	10-1	M	119A
238-6	10-1	M	119B
239-7	10-1	M	120A
240-8	10-1	M	120B
241-9	10-1	M	121A
242-0	10-1	M	121B
243-1	10-1	M	122A
244-2	10-1	M	122B
245-3	10-1	M	123A
246-4	10-1	M	123B
247-5	10-1	M	124A
248-6	10-1	M	124B
249-7	10-1	M	125A
250-8	10-1	M	125B
251-9	10-1	M	126A
252-0	10-1	M	126B
253-1	10-1	M	127A
254-2	10-1	M	127B
255-3	10-1	M	128A
256-4	10-1	M	128B
257-5	10-1	M	129A
258-6	10-1	M	129B
259-7	10-1	M	130A
260-8	10-1	M	130B
261-9	10-1	M	131A
262-0	10-1	M	131B
263-1	10-1	M	132A
264-2	10-1	M	132B
265-3	10-1	M	133A
266-4	10-1	M	133B
267-5	10-1	M	134A
268-6	10-1	M	134B
269-7	10-1	M	135A
270-8	10-1	M	135B
271-9	10-1	M	136A
272-0	10-1	M	136B
273-1	10-1	M	137A
274-2	10-1	M	137B
275-3	10-1	M	138A
276-4	10-1	M	138B
277-5	10-1	M	139A
278-6	10-1	M	139B
279-7	10-1	M	140A
280-8	10-1	M	140B
281-9	10-1	M	141A
282-0	10-1	M	141B
283-1	10-1	M	142A
284-2	10-1	M	142B
285-3	10-1	M	143A
286-4	10-1	M	143B
287-5	10-1	M	144A
288-6	10-1	M	144B
289-7	10-1	M	145A
290-8	10-1	M	145B
291-9	10-1	M	146A
292-0	10-1	M	146B
293-1	10-1	M	147A
294-2	10-1	M	147B
295-3	10-1	M	148A
296-4	10-1	M	148B
297-5	10-1	M	149A
298-6	10-1	M	149B
299-7	10-1	M	150A
300-8	10-1	M	150B
301-9	10-1	M	151A
302-0	10-1	M	151B
303-1	10-1	M	152A
304-2	10-1	M	152B
305-3	10-1	M	153A
306-4	10-1	M	153B
307-5	10-1	M	154A
308-6	10-1	M	154B
309-7	10-1	M	155A
310-8	10-1	M	155B
311-9	10-1	M	156A
312-0	10-1	M	156B
313-1	10-1	M	157A
314-2	10-1	M	157B
315-3	10-1	M	158A
316-4	10-1	M	158B
317-5	10-1	M	159A
318-6	10-1	M	159B
319-7	10-1	M	160A
320-8	10-1	M	160B
321-9	10-1	M	161A
322-0	10-1	M	161B
323-1	10-1	M	162A
324-2	10-1	M	162B
325-3	10-1	M	163A
326-4	10-1	M	163B
327-5	10-1	M	164A
328-6	10-1	M	164B
329-7	10-1	M	165A
330-8	10-1	M	165B
331-9</			



The three paragraphs used in obtaining data were taken from the "Durrell Analysis of Reading Difficulty", and are included below. The underlined sentences indicate those recorded.

## 2. The Cat and The Dog

A boy had a big gray cat. He was going to give her some milk. She did not come when he called. He saw her up in a tree looking down at a big dog. The boy sent the dog away. Then the cat jumped down and came for her milk.

## 4. The Accident

A boy was hurt on our street yesterday. He had been playing ball and was riding his bicycle away from the ball field when a car came down the road. He did not see the car coming because he was looking back at the boys who were still playing baseball. The car was going slowly. It hit the boy, but did not run over him. His arm was hurt and his bicycle was bent.

## 6. Uses of Kites

Large kites have been used for a great many things. In war they have been used to carry signal lanterns and to carry automatic cameras over enemy territory. One general used kites to pull ropes over a swift river so that he could start to build a swinging bridge. Some people in China make "singing kites" which are supposed to frighten away evil spirits. The weather bureau has used kites to study temperature and the speed of the wind at great heights. A string of kites once went up over four miles in the air. Some kites are big enough to lift a man.

The three paragraphs used in obtaining data were taken from the "Harrell Analysis of Mental Illness", and are included below. The unpublished analyses are listed in the enclosed.

### 2. The Cat and the Dog

A boy had a big grey cat. He was going to take her some milk. She did not come when he called. He saw her up in a tree looking down at a big dog. The boy went the dog away. When she had jumped down and came for her milk.

### 3. The Accident

A boy was hurt on our street yesterday. He had been playing ball and was riding his bicycle away from his home when a car came down the road. He did not see the car coming because he was looking back at the boys who were still playing baseball. The car was going slowly. It hit the boy, and he fell over his head. His arm was hurt and his bicycle was bent.

### 4. Uses of Mirrors

Large mirrors have been used for a long time. In the past they were used to carry light into dark places and to carry light into places over many footings. One person used them to tell people over a wide river so that he could start to build a bridge. Some people use them to see things which are supposed to be hidden away with light. The mirror has been used to study temperature and the speed of the wind at great heights. A series of mirrors were used to see four miles in the air. Some mirrors are big enough to lift a man.



### Criteria Used in the Scoring of Reading Errors

Since a large discrepancy exists between the reading errors reported in this investigation and those reported by two other investigators, (page 32) it was thought advisable to include the criteria this author followed in judging a reading error. The criteria are as follows:

(1) Word-by-word reading, occasional phrase reading and inadequate phrase reading were understood all to be the same error, differing in degree. Word-by-word reading was scored when the child read three or more phrases in a word-by-word manner. The halting that accompanies the appearance of an unfamiliar word in the sentence is thus, not scored. If the error persists, the word-by-word reading becomes occasional phrase reading. In addition to this, when the phrases are read unintelligently, destroying thought units, the author scored inadequate phrase reading. The last error indicates that both of the former are present.

(2) The voice, enunciation and expression errors cannot be followed in any such rigid manner. Sufficient to say that a "strained, high-pitched voice" can only be scored if the child's voice is in his highest register, not if the voice appears higher in relation to the others in his reading group. A high-pitch voice, which may sound strained, is the customary voice for some types of children, and this high-pitched voice may have its own higher and lower tones. If, through conversation we first discover the child's unusual pitch level

Criteria used in the scoring of reading errors

Since a large discrepancy exists between the reading

errors reported in this investigation and those reported by

two other investigators, (page 52) it was thought advisable

to include the criteria this author followed in judging a

reading error. The criteria are as follows:

(1) Word-by-word reading, occasional phrase reading and

inadequate phrase reading were understood all to be the same

error, differing in degree. Word-by-word reading was scored

when the child read three or more phrases in a word-by-word

manner. The difficulty was not reported in the presence of an

unfamiliar word in the sentence in this case. If the

error occurred, the word-by-word reading became occasional

phrase reading. Qualification to this, when the phrases are

read without any hesitations or pauses, the student

scored inadequate phrase reading. The last error indicated that

both of the former are present.

(2) The voice, pronunciation and expressive errors cannot

be followed in any word in this manner. The student is not

a "corrected, high-pitched voice" can only be scored if the

child's voice is in the highest register, not in the voice

register which is common to the others in the reading group.

A high-pitched voice, when any sound is heard, is the customary

voice for the type of children, and this high-pitched voice

may have its own effect on the reader. It is, however,

considered a "corrected, high-pitched voice" when it is heard



the error only when his reading utilizes pitches above this prevailing tone of delivery.

(3) Monotonous tone and inadequate expression were taken to mean distinct comments. Monotonous tone in this study has distinct reference to the rhythm and pitch of the voice. Monotonous tone indicates a lack of expression, but may not be scored in place of it. Inadequate expression was not scored until after the child had given the recall of the material. If the recall was adequate, yet the reading conveyed the impression that the child did not comprehend the passage while reading, the error was checked. If, on the other hand, the recall bore out the original impression that the child did not understand the reading material, the error checked was poor comprehension, or inadequate recall.

(4) The enunciation errors depend largely upon the examiner's own ear and speech habits, interpreted with a knowledge of the standards of speech set by the educated leaders in the community. Since, in this study, a picture of the general speech habits was wanted, the errors included under enunciation were largely errors of elisions and assimilations, mumbled speech and speech sound substitutions (if they occurred infrequently enough to be classified as an error and not a defect).

(5) Ignoring of punctuation and the habitual repetition of words are both comments that contain specific determinants of frequency, and hence, could only be checked once if the error

the error only when the reading material appears above this

present in the form of a letter.

(3) The error was made and independent expression were taken

to mean distinct comments. Therefore some in this study was

distinct reference to the right and left of the notes.

Somebody else indicated a lack of understanding, but may not be

scored in place of it. Independent expression was not noted

until after the child had given the result of the material. If

the result was adequate, yet the reading conveyed the impression

that the child did not comprehend the message while reading, the

error was checked. If, on the other hand, the result began out

the original material, the error checked was poor comprehension, or

reading material, the error checked was poor comprehension, or

independent recall.

(4) The experimental errors depend largely upon the

children's own set and speech habits. Interviewed with a

knowledge of the standards of speech set by the educated

leaders in the community. Also, in this study, a picture of

the general speech habits was wanted, the errors included under

enumeration were largely errors of omission and commission.

omitted speech and speech sound substitutions (if they

occurred sufficiently enough to be classified as an error and

not a defect.

(5) The error of pronunciation and the position of the

of words are both considered. The error of pronunciation of

frequency, and hence, could only be checked once in the error



v

occurs more than once. In this study, however, the errors were assumed to mean "How many times does the child ignore punctuation?" and "How often does he repeat words?" Thus, any repetition of words or disregard of punctuation was scored. This, of course, accounts for one great difference in the total number of errors reported in this investigation.

(6) "Sight vocabulary too small" was not checked in reference to the reading of Paragraph 6, since fourth grade children can hardly be expected to master sixth grade reading. In addition, the error was noted only if the child had to be prompted on two or more words.

(7) The greatest percentage of reading errors in this investigation was "errors on smaller words". As in Paragraph 5 (above) any error on any small word was checked. This error was largely in Paragraph 2 when "He saw her up in a tree" was read as "He saw her up in the tree." Although it verges on the trifling to record this as an error, it was done, nevertheless.

(8) Unfortunately, "word insertions and omissions" was not broken down into two separate errors, for when the data had been assembled, it was impossible to determine which error was responsible for the total high percentage reported. As in the two above criteria, any insertion or any omission was checked.

(9) The last error about which there may be doubt is that of "inaccurate guessing on words". If a child sounded

occurs more than once. In this study, however, the errors were assumed to mean "how many times does the child ignore punctuation?" and "how often does he repeat words?" Thus, any repetition of words or disregard of punctuation was assumed. This, of course, accounts for one great difference in the total number of errors reported in this investigation. (6) "Right vocabulary, too small" was not checked in reference to the reading of paragraph 6, since fourth grade children can hardly be expected to master sixth grade reading. In addition, the error was noted only if the child had to be prompted on two or more words.

(7) The greatest percentage of reading errors in this investigation was "errors on smaller words". As in paragraph 6 (above) any error on any small word was checked. This error was largely in paragraph 2 when "He saw her up in a tree" was read as "He saw her up in the tree." Although it varies on the first line record this is an error, it was done, nevertheless.

(8) Unfortunately, "word insertions and omissions" was not broken down into two separate errors, for when the data had been assembled, it was impossible to determine which error was responsible for the total high percentage reported. As in the above criteria, any insertion or any omission was checked.

(9) The last error count which there may be doubt is that of "incomplete guessing of words". It is a little rounded



a word out by a phonetic method, yet arrived at an incorrect pronunciation (e.g. since an "e" on the end of a word makes a single vowel say its own name, the terminal "e" on "bridge" might result in the pronunciation of "bry-dge") the error was not checked, and the correct pronunciation was given. If, however, the word above was sounded out as "drige" or "bride" or some such combination, the error was scored.

a word out by a phonetic method, yet arrived at an incorrect  
pronunciation (e.g. place on "o" on the end of a word makes  
a single vowel say the same, the terminal "e" on "bridge"  
might result in the pronunciation of "dy-ge") the error  
was not detected, and the correct pronunciation was given. If,  
however, the word above was sounded out as "bridge" or "bridge"  
at the same conclusion, the error was noted.



Table B

First and Second Judgments of Each Judge on 90  
Selected Syllables

First Judgments			Second Judgments		
Judge 1	Judge 2	Judge 3	Judge 1	Judge 2	Judge 3
9B					
D#	D#	D#	D#	D#	D#
E	E	E	E	E	E
D	D	D	D	D	D#
D#	D#	D#	D	D	D
D	D	D	D	D	D
F	F	F	F	F	F
D#	D#	D#	D#	D#	D#
D	D	D	D	D	D
D	D	D	D	D	D
D	D	D	D#	D#	D
B.	B.	B.	C	B.	B
C#	C#	C#	C	B.	C#
D	D	D	C"	D	D
C#	C#	C#	B.	C	B.
D	D	D	C#	D	C
C#	C#	C#	C	C	C#
C#	C#	C#	C#	C	C#
A#	A#	A#	C#	C	A#
C	C	C	B.	B.	A#.
A#.	A#.	A#.	C.	C.	B.
B.	B.	B.	C	C	C#
A#.	A#.	A#.	A#.	A.	B.
B.	B.	B.	C	A#.	B.
B.	B.	B.	C	A#.	B.
C#	C#	C#	C	C	C
C	C	C	C	C	C#
B.	B.	B.	B.	B.	B.
D	D	D	D	D	C#
B.	B.	B.	B.	B.	B.
D	D	D	D	D	E
A.	A.	A.	A.	A.	A.
D#	D#	D#	D#	E	D#
D	D	D	D#	D#	D#
C#	C#	C#	D#	C	C
D#	D#	D#	D#	D#	D#
4A					
G#	G#	G#	A#	C	F
G#	G#	G#	A#	C	F
C'	C'	C'	C'	C	C'
C'	C'	C'	C'	C'	C'
C'	C'	C'	C'	C'	C'
D#	D#	D#	D#	D#	D#
D#	D#	D#	D#	D#	E





Table B (con.)

First Judgments			Second Judgments		
Judge 1	Judge 2	Judge 3	Judge 1	Judge 2	Judge 3
C	C	C	C	C	D
G	G	F	G	G	G
C	C	E	C	D#	D
F#	F#	F#	F#	F#	F#
F	F	F	F	F	F
E	E	E	E	D#	E
C	C	C	C#	C	C
B.	B.	B.	B.	B.	A#.
B.	B.	B.	B.	B.	B.
C	C	C	C	C	C
C	C	C	C	C	D
C	C	C	C	C	D
E	E	E	E	E	E
D	D	D	D	D	D
D	D	D	D	C#	C
E	E	E	D#	D#	D#
B.	B.	B.	B.	B.	B.
D	D	D	C#	D	D
C	C	C	C#	C#	C#
B.	B.	B.	B.	B.	B.
D	D	D	D	C#	C#
C	C	C	C	C	C
C	C	C	C	C	C#
1B	D	D	D#	D#	D
	D	D	D#	D#	E
	D	D	D#	D#	D
	F	F	F	F	F
	E	E	E	E	E
	D#	D#	D#	D#	D#
	C	C	C	C	A
	B.	B.	B.	B.	G
	C	C	C	C	G#
	C	C	C	C	G#
	B.	B.	B.	B.	B.
	C	C	C	C	C
	B.	B.	C#	C	C
	C#	C#	B.	B.	B.
	C	C	C#	C#	C#
	B.	B.	B.	C	B.
	C	C	C	C#	C
	F.	F.	A#.	B.	A#.
	D	D	D	C	C
	C	C	C	B.	B.
	D#	D#	C	C	B.
	A#	A#	A#.	A#	A#
	D	D	C#	C#	C#
	B.	B.	B.	B.	B.
	D	D	D	D	D



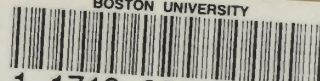


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